RETURN TO MAIN MENU

SVM182-A

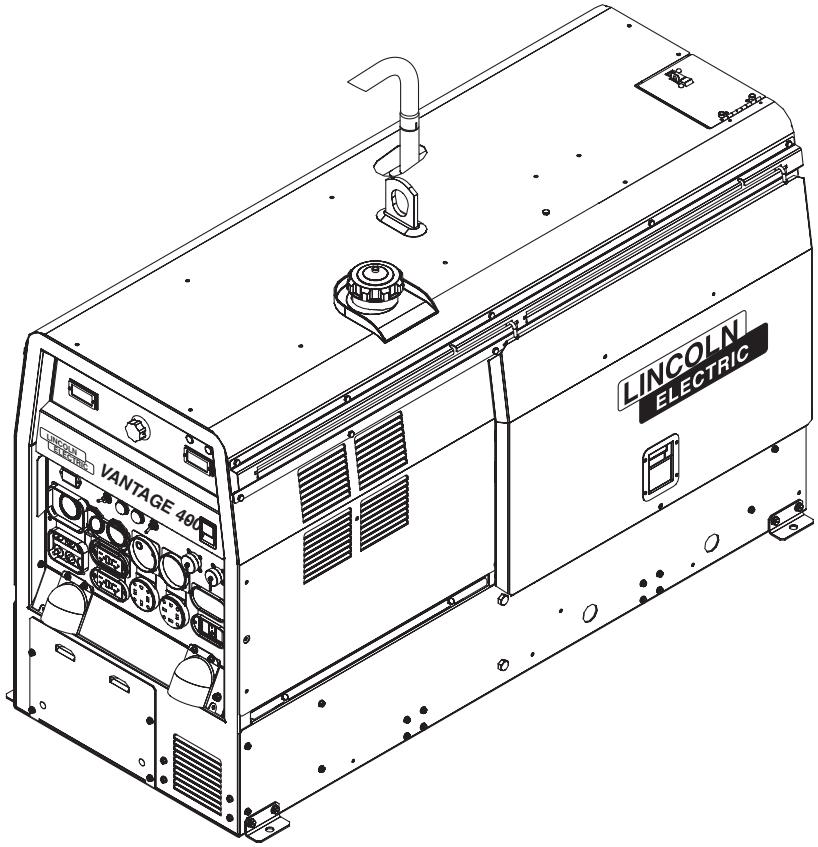
April, 2011

VANTAGE® 400

For use with machines having Code Numbers: 11186, 11462

Safety Depends on You

Lincoln arc welding and cutting equipment is designed and built with safety in mind. However, your overall safety can be increased by proper installation ... and thoughtful operation on your part. DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT. And, most importantly, think before you act and be careful.



SERVICE MANUAL

LINCOLN® ELECTRIC

• World's Leader in Welding and Cutting Products •
• Sales and Service through Subsidiaries and Distributors Worldwide •
Cleveland, Ohio 44117-1199 U.S.A. TEL: 888.935.3877 FAX: 216.486.1751 WEB SITE: www.lincolnelectric.com

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⚠ WARNING

⚠ CALIFORNIA PROPOSITION 65 WARNINGS ⚠

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

The Above For Diesel Engines

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

The Above For Gasoline Engines

ARC WELDING can be hazardous. PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. PACEMAKER WEARERS SHOULD CONSULT WITH THEIR DOCTOR BEFORE OPERATING.

Read and understand the following safety highlights. For additional safety information, it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting - ANSI Standard Z49.1" from the American Welding Society, P.O. Box 351040, Miami, Florida 33135 or CSA Standard W117.2-1974. A Free copy of "Arc Welding Safety" booklet E205 is available from the Lincoln Electric Company, 22801 St. Clair Avenue, Cleveland, Ohio 44117-1199.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

FOR ENGINE powered equipment.

1.a. Turn the engine off before troubleshooting and maintenance work unless the maintenance work requires it to be running.

1.b. Operate engines in open, well-ventilated areas or vent the engine exhaust fumes outdoors.

1.c. Do not add the fuel near an open flame welding arc or when the engine is running. Stop the engine and allow it to cool before refueling to prevent spilled fuel from vaporizing on contact with hot engine parts and igniting. Do not spill fuel when filling tank. If fuel is spilled, wipe it up and do not start engine until fumes have been eliminated.

1.d. Keep all equipment safety guards, covers and devices in position and in good repair.Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.

1.e. In some cases it may be necessary to remove safety guards to perform required maintenance. Remove guards only when necessary and replace them when the maintenance requiring their removal is complete. Always use the greatest care when working near moving parts.

1.f. Do not put your hands near the engine fan. Do not attempt to override the governor or idler by pushing on the throttle control rods while the engine is running.

1.g. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.

1.h. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

ELECTRIC AND MAGNETIC FIELDS may be dangerous

2.a. Electric current flowing through any conductor causes localized Electric and Magnetic Fields (EMF). Welding current creates EMF fields around welding cables and welding machines

2.b. EMF fields may interfere with some pacemakers, and welders having a pacemaker should consult their physician before welding.

2.c. Exposure to EMF fields in welding may have other health effects which are now not known.

2.d. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

2.d.1. Route the electrode and work cables together - Secure them with tape when possible.

2.d.2. Never coil the electrode lead around your body.

2.d.3. Do not place your body between the electrode and work cables. If the electrode cable is on your right side, the work cable should also be on your right side.

2.d.4. Connect the work cable to the workpiece as close as possible to the area being welded.

2.d.5. Do not work next to welding power source.

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ELECTRIC SHOCK can kill.

3.a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Do not touch these "hot" parts with your bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.

3.b. Insulate yourself from work and ground using dry insulation. Make certain the insulation is large enough to cover your full area of physical contact with work and ground.

In addition to the normal safety precautions, if welding must be performed under electrically hazardous conditions (in damp locations or while wearing wet clothing; on metal structures such as floors, gratings or scaffolds; when in cramped positions such as sitting, kneeling or lying, if there is a high risk of unavoidable or accidental contact with the workpiece or ground) use the following equipment:

- **Semiautomatic DC Constant Voltage (Wire) Welder.**
- **DC Manual (Stick) Welder.**
- **AC Welder with Reduced Voltage Control.**

3.c. In semiautomatic or automatic wire welding, the electrode, electrode reel, welding head, nozzle or semiautomatic welding gun are also electrically "hot".

3.d. Always be sure the work cable makes a good electrical connection with the metal being welded. The connection should be as close as possible to the area being welded.

3.e. Ground the work or metal to be welded to a good electrical (earth) ground.

3.f. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition. Replace damaged insulation.

3.g. Never dip the electrode in water for cooling.

3.h. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.

3.i. When working above floor level, use a safety belt to protect yourself from a fall should you get a shock.

3.j. Also see Items 6.c. and 8.

ARC RAYS can burn.

4.a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Headshield and filter lens should conform to ANSI Z87. I standards.

4.b. Use suitable clothing made from durable flame-resistant material to protect your skin and that of your helpers from the arc rays.

4.c. Protect other nearby personnel with suitable, non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.

FUMES AND GASES can be dangerous.

5.a. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases.When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. **When welding with electrodes which require special ventilation such as stainless or hard facing (see instructions on container or MSDS) or on lead or cadmium plated steel and other metals or coatings which produce highly toxic fumes, keep exposure as low as possible and within applicable OSHA PEL and ACGIH TLV limits using local exhaust or mechanical ventilation. In confined spaces or in some circumstances, outdoors, a respirator may be required. Additional precautions are also required when welding on galvanized steel.**

5. b. The operation of welding fume control equipment is affected by various factors including proper use and positioning of the equipment, maintenance of the equipment and the specific welding procedure and application involved. Worker exposure level should be checked upon installation and periodically thereafter to be certain it is within applicable OSHA PEL and ACGIH TLV limits.

5.c. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.

5.d. Shielding gases used for arc welding can displace air and cause injury or death. Always use enough ventilation, especially in confined areas, to insure breathing air is safe.

5.e. Read and understand the manufacturer's instructions for this equipment and the consumables to be used, including the material safety data sheet (MSDS) and follow your employer's safety practices. MSDS forms are available from your welding distributor or from the manufacturer.

5.f. Also see item 1.b.

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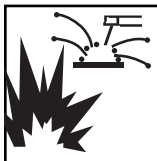

WELDING and CUTTING SPARKS can cause fire or explosion.

6.a. Remove fire hazards from the welding area.If this is not possible, cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjcent areas. Avoid welding near hydraulic lines. Have a fire extinguisher readily available.

6.b. Where compressed gases are to be used at the job site, special precautions should be used to prevent hazardous situations. Refer to “Safety in Welding and Cutting” (ANSI Standard Z49.1) and the operating information for the equipment being used.

6.c. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.

6.d. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been “cleaned”. For information, purchase “Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping That Have Held Hazardous Substances”, AWS F4.1 from the American Welding Society (see address above).

6.e. Vent hollow castings or containers before heating, cutting or welding. They may explode.

6.f. Sparks and spatter are thrown from the welding arc. Wear oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places. Always wear safety glasses with side shields when in a welding area.

6.g. Connect the work cable to the work as close to the welding area as practical. Work cables connected to the building framework or other locations away from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.

6.h. Also see item 1.c.

6.I. Read and follow NFPA 51B “ Standard for Fire Prevention During Welding, Cutting and Other Hot Work”, available from NFPA, 1 Batterymarch Park,PO box 9101, Quincy, Ma 022690-9101.

6.j. Do not use a welding power source for pipe thawing.

CYLINDER may explode if damaged.

7.a. Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. All hoses, fittings, etc. should be suitable for the application and maintained in good condition.

7.b. Always keep cylinders in an upright position securely chained to an undercarriage or fixed support.

7.c. Cylinders should be located:

- Away from areas where they may be struck or subjected to physical damage.
- A safe distance from arc welding or cutting operations and any other source of heat, sparks, or flame.

7.d. Never allow the electrode, electrode holder or any other electrically “hot” parts to touch a cylinder.

7.e. Keep your head and face away from the cylinder valve outlet when opening the cylinder valve.

7.f. Valve protection caps should always be in place and hand tight except when the cylinder is in use or connected for use.

7.g. Read and follow the instructions on compressed gas cylinders, associated equipment, and CGA publication P-I, “Precautions for Safe Handling of Compressed Gases in Cylinders,” available from the Compressed Gas Association 1235 Jefferson Davis Highway, Arlington, VA 22202.

FOR ELECTRICALLY powered equipment.

8.a. Turn off input power using the disconnect switch at the fuse box before working on the equipment.

8.b. Install equipment in accordance with the U.S. National Electrical Code, all local codes and the manufacturer’s recommendations.

8.c. Ground the equipment in accordance with the U.S. National Electrical Code and the manufacturer’s recommendations.

Refer to **http://www.lincolnelectric.com/safety** for additional safety information.

PRÉCAUTIONS DE SÛRETÉ

Pour votre propre protection lire et observer toutes les instructions et les précautions de sûreté specifiques qui parraissent dans ce manuel aussi bien que les précautions de sûreté générales suivantes:

Sûreté Pour Soudage A L'Arc

1. Protegez-vous contre la secousse électrique:

   a. Les circuits à l'électrode et à la piéce sont sous tension quand la machine à souder est en marche. Eviter toujours tout contact entre les parties sous tension et la peau nue ou les vétements mouillés. Porter des gants secs et sans trous pour isoler les mains.
   b. Faire trés attention de bien s'isoler de la masse quand on soude dans des endroits humides, ou sur un plancher metallique ou des grilles metalliques, principalement dans les positions assis ou couché pour lesquelles une grande partie du corps peut être en contact avec la masse.
   c. Maintenir le porte-électrode, la pince de masse, le câble de soudage et la machine à souder en bon et sûr état defonctionnement.
   d. Ne jamais plonger le porte-électrode dans l'eau pour le refroidir.
   e. Ne jamais toucher simultanément les parties sous tension des porte-électrodes connectés à deux machines à souder parce que la tension entre les deux pinces peut être le total de la tension à vide des deux machines.
   f. Si on utilise la machine à souder comme une source de courant pour soudage semi-automatique, ces precautions pour le porte-électrode s'applicuent aussi au pistolet de soudage.

2. Dans le cas de travail au dessus du niveau du sol, se protéger contre les chutes dans le cas ou on recoit un choc. Ne jamais enrouler le câble-électrode autour de n'importe quelle partie du corps.

3. Un coup d'arc peut être plus sévère qu'un coup de soliel, donc:

   a. Utiliser un bon masque avec un verre filtrant approprié ainsi qu'un verre blanc afin de se protéger les yeux du rayonnement de l'arc et des projections quand on soude ou quand on regarde l'arc.
   b. Porter des vêtements convenables afin de protéger la peau de soudeur et des aides contre le rayonnement de l'arc.
   c. Protéger l'autre personnel travaillant à proximité au soudage à l'aide d'écrans appropriés et non-inflammables.

4. Des gouttes de laitier en fusion sont émises de l'arc de soudage. Se protéger avec des vêtements de protection libres de l'huile, tels que les gants en cuir, chemise épaisse, pantalons sans revers, et chaussures montantes.

5. Toujours porter des lunettes de sécurité dans la zone de soudage. Utiliser des lunettes avec écrans lateraux dans les zones où l'on pique le laitier.

6. Eloigner les matériaux inflammables ou les recouvrir afin de prévenir tout risque d'incendie dû aux étincelles.

7. Quand on ne soude pas, poser la pince à une endroit isolé de la masse. Un court-circuit accidental peut provoquer un échauffement et un risque d'incendie.

8. S'assurer que la masse est connectée le plus prés possible de la zone de travail qu'il est pratique de le faire. Si on place la masse sur la charpente de la construction ou d'autres endroits éloignés de la zone de travail, on augmente le risque de voir passer le courant de soudage par les chaines de levage, câbles de grue, ou autres circuits. Cela peut provoquer des risques d'incendie ou d'echauffement des chaines et des câbles jusqu'à ce qu'ils se rompent.

9. Assurer une ventilation suffisante dans la zone de soudage. Ceci est particuliérement important pour le soudage de tôles galvanisées plombées, ou cadmiées ou tout autre métal qui produit des fumeés toxiques.

10. Ne pas souder en présence de vapeurs de chlore provenant d'opérations de dégraissage, nettoyage ou pistolage. La chaleur ou les rayons de l'arc peuvent réagir avec les vapeurs du solvant pour produire du phosgéne (gas fortement toxique) ou autres produits irritants.

11. Pour obtenir de plus amples renseignements sur la sûreté, voir le code "Code for safety in welding and cutting" CSA Standard W 117.2-1974.

PRÉCAUTIONS DE SÛRETÉ POUR LES MACHINES À SOUDER À TRANSFORMATEUR ET À REDRESSEUR

1. Relier à la terre le chassis du poste conformement au code de l'électricité et aux recommendations du fabricant. Le dispositif de montage ou la piece à souder doit être branché à une bonne mise à la terre.

2. Autant que possible, l'installation et l'entretien du poste seront effectués par un électricien qualifié.

3. Avant de faires des travaux à l'interieur de poste, la debrancher à l'interrupteur à la boite de fusibles.

4. Garder tous les couvercles et dispositifs de sûreté à leur place.

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TECHNICAL SPECIFICATIONS - VANTAGE® 400 (K2410-1) (K2410-2)

INPUT - DIESEL ENGINE

Make/Model PERKINS	Description	Speed (RPM)	Displacement cu. in. (ltrs.)	Starting System	Capacities
(K2410-1) 404C-22	4 cylinder 32.7 HP 1800 RPM naturally aspirated water cooled Diesel Engine	High Idle 1880	135.6(2.2)	12VDC Battery & starter	Fuel: 15 gal. (57 L)
			Bore x Stroke inch (mm)	(Group 34; 650 cold crank amps)	Oil: 8.45Qts. (8L)
(K2410-2) 404D-22		Full Load 1800	3.43 X 3.64 (87.1 x 92.5mm)	65 Amp Alternator W / Built in Regulator	Radiator Coolant: 8.0 Qts. (7.6L)
		Low Idle 1400			

RATED OUTPUT @ 104° F (40° C) - WELDER

Welding Process	Welding Output Current/Voltage/Duty Cycle	Output Range	Max. Weld OCV @Rated Load RPM
DC Constant Current	400A / 36V / 100% 450A / 32V / 100%	30 TO 500 AMPS	60 Volts[2]
DC Pipe Current	300A / 32V / 100%	40 TO 300 AMPS	
Touch-Start™TIG	250A / 30V / 100%	20 TO 250 AMPS	
DC Constant Voltage	400A / 36V / 100% 450A / 32V / 100%	14 TO 36 VOLTS	

RATED OUTPUT @ 104° F (40° C) - GENERATOR

Auxiliary Power [1]

12,000 Watts Peak, / 11,000 Watts Continuous, 60 Hz 120/240 Volts Single Phase
19,000 Watts Peak, / 17,000 Watts Continuous, 60 Hz, 240 Volts 3-Phase

PHYSICAL DIMENSIONS

HEIGHT	WIDTH	DEPTH	WEIGHT
35.94* in. 913 mm	25.30 in 643 mm	60.00 in. 1524 mm	1230 lbs. (559kg.)

ENGINE

LUBRICATION	EMISSIONS	FUEL SYSTEM	GOVERNOR
Full Pressure with Full Flow Filter	(K2410-1) EPA Tier II (K2410-2) EPA Tier 4 Interim	Mechanical Fuel Pump, Auto air bleed system Electric shutoff solenoid, Indirect fuel injector.	Mechanical

AIR CLEANER	ENGINE IDLER	MUFFLER	ENGINE PROTECTION
Single Element	Automatic Idler	Low noise Muffler: Top outlet can be rotated. Made from long life, aluminized steel.	Shutdown on low oil pressure & high engine coolant temperature

ENGINE WARRANTY: 2 years / 2000 hours, all non-electric components, 3 years major non-electric components . See Perkins warranty for details.

MACHINE SPECIFICATIONS

RECEPTACLES	AUXILIARY POWER CIRCUIT BREAKER	OTHER CIRCUIT BREAKERS
(2) 120VAC GFCI Duplex (5-20R) (1) 120/240VAC Dual Voltage Full KVA (14-50R) (1) 240VAC 3-Phase (15-50R)	Two 20AMP for Two Duplex Receptacle (1) 50AMP for Dual Voltage and for 3-Phase (3-pole)	10AMP for Battery Charging Circuit 10AMP for 42V Wire Feeder Power

1. Output rating in watts is equivalent to volt-amperes at unity power factor. Output voltage is within ± 10% at all loads up to rated capacity. When welding, available auxiliary power will be reduced.

* To Top of enclosure, add 10.68"(271.3mm) to top of exhaust pipe. Add 6.67"(169.4mm) to top of Lift Bail.

2. Reduced to less than 32V in the CC-stick Mode when VRD (VOLTAGE REDUCTION DEVICE) is on.

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SAFETY PRECAUTIONS

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.

ELECTRIC SHOCK can kill.
- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground**
- **Always wear dry insulating gloves.**

ENGINE EXHAUST can kill.
- **Use in open, well ventilated areas or vent exhaust outside.**

MOVING PARTS can injure.
- **Do not operate with doors open or guards off.**
- **Stop engine before servicing.**
- **Keep away from moving parts.**

See additional warning information at front of this operator's manual.

Only qualified personnel should install, use, or service this equipment.

VRD (VOLTAGE REDUCTION DEVICE)

The VRD feature provides additional safety in the CC-Stick mode especially in an environment with a higher risk of electric shock such as wet areas and hot humid sweaty conditions.

The VRD reduces the OCV (Open Circuit Voltage) at the welding output terminals while not welding to less than 32V DC when the resistance of the output circuit is above 200Ω (ohms).

The VRD requires that the welding cable connections be kept in good electrical condition because poor connections will contribute to poor starting. Having good electrical connections also limits the possibility of other safety issues such as heat-generated damage, burns and fires.

The machine is shipped with the VRD switch in the "Off" position. To turn it "On" or "Off":
- Turn the engine "Off".
- Disconnect the negative battery cable.
- Lower the control panel.
- Place the VRD switch in the "On or "Off" position.

With the VRD switch in the "On" position, the VRD lights are enabled.

LOCATION AND VENTILATION

The welder should be located to provide an unrestricted flow of clean, cool air to the cooling air inlets and to avoid restricting the cooling air outlets. Also, locate the welder so that the engine exhaust fumes are properly vented to an outside area.

STACKING

VANTAGE® 400 machines cannot be stacked.

ANGLE OF OPERATION

Engines are designed to run in the level condition which is where the optimum performance is achieved. The maximum angle of continuous operation is 25 degrees in all directions, 35 degrees Intermittent (less than 10 minutes continuous) in all directions. If the engine is to be operated at an angle, provisions must be made for checking and maintaining the oil level at the normal (FULL) oil capacity in the crankcase.

When operating the welder at an angle, the effective fuel capacity will be slightly less than the amount specified.

LIFTING

The VANTAGE® 400 weighs approximately 1345lbs. (611kg.) with a full tank of fuel 1230lbs.(559kg) less fuel. A lift bail is mounted to the machine and should always be used when lifting the machine.

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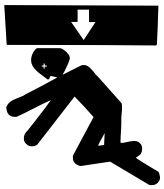
⚠ WARNING



FALLING EQUIPMENT can cause injury.

- **Lift only with equipment of adequate lifting capacity.**
- **Be sure machine is stable when lifting.**
- **Do not lift this machine using lift bail if it is equipped with a heavy accessory such as trailer or gas cylinder.**
- **Do not lift machine if lift bail is damaged.**
- **Do not operate machine while suspended from lift bail.**

HIGH ALTITUDE OPERATION

At higher altitudes, output derating may be necessary. For maximum rating, derate the machine 2.5% to 3.5% for every 1000 ft. (305m). Due to new EPA and other local emissions regulations, modifications to the engine for high altitude are restricted within the United States. For use above 6000 ft.(1828 m) an authorized Perkins engine field service shop should be contacted to determine if any adjustments can be made for operation in higher elevations.

HIGH TEMPERATURE OPERATION

At temperatures above 104°F(40°C), Welder output derating is necessary. For maximum output ratings, derate the welder output 2 volts for every 18°F(10°C) above 104°F(40°C).

COLD WEATHER STARTING:

With a fully charged battery and the proper oil, the engine should start satisfactorily down to -15°F(-26C°). If the engine must be frequently started at or below 0°F (-18°C), it may be desirable to install cold-starting aides. The use of No. 1D diesel fuel is recommended in place of No. 2D at temperatures below 23°F (-5°C). Allow the engine to warm up before applying a load or switching to high idle.

Note: Extreme cold weather starting may require longer glow plug operation.

⚠ WARNING

Under no conditions should ether or other starting fluids be used with this engine!

TOWING

Use a recommended trailer for use with this equipment for road, in-plant and yard towing by a vehicle(1). If the user adapts a non-Lincoln trailer, he must assume responsibility that the method of attachment and usage does not result in a safety hazard or damage the welding equipment. Some of the factors to be considered are as follows:

1. Design capacity of trailer vs. weight of Lincoln equipment and likely additional attachments.
2. Proper support of, and attachment to, the base of the welding equipment so there will be no undue stress to the framework.
3. Proper placement of the equipment on the trailer to insure stability side to side and front to back when being moved and when standing by itself while being operated or serviced.
4. Typical conditions of use, i.e., travel speed; roughness of surface on which the trailer will be operated; environmental conditions; like maintenance.
5. Conformance with federal, state and local laws.(1)

(1) Consult applicable federal, state and local laws regarding specific requirements for use on public highways.

VEHICLE MOUNTING

⚠ WARNING

Improperly mounted concentrated loads may cause unstable vehicle handling and tires or other components to fail.

- **Only transport this Equipment on serviceable vehicles which are rated and designed for such loads.**
- **Distribute, balance and secure loads so vehicle is stable under conditions of use.**
- **Do not exceed maximum rated loads for components such as suspension, axles and tires.**
- **Mount equipment base to metal bed or frame of vehicle.**
- **Follow vehicle manufacturer's instructions.**

PRE-OPERATION ENGINE SERVICE

READ the engine operating and maintenance instructions supplied with this machine.

⚠ WARNING

- **Stop engine and allow to cool before fueling**
- **Do not smoke when fueling.**
- **Fill fuel tank at a moderate rate and do not overfill.**
- **Wipe up spilled fuel and allow fumes to clear before starting engine.**
- **Keep sparks and flame away from tank.**

OIL

The VANTAGE® 400 is shipped with the engine crankcase filled with high quality SAE 10W-30 Oil that meets classification CG-4 or CH-4 for diesel engines. Check the oil level before starting the engine. If it is not up to the full mark on the dip stick, add oil as required. Check the oil level every four hours of running time during the first 50 running hours. Refer to the engine Operator's Manual for specific oil recommendations and break-in information. The oil change interval is dependent on the quality of the oil and the operating environment. Refer to the Engine Operator's Manual for more details on the proper service and maintenance intervals.

FUEL

USE DIESEL FUEL ONLY

⚠ WARNING

- **Fill the fuel tank with clean, fresh fuel. The capacity of the tank is 15 gals. (57 ltrs). When the fuel gauge reads empty the tank contains approximately 2 gals. (7.6ltrs.) of reserve fuel.**

⚠ WARNING

NOTE: A fuel shut off valve is located on the pre-filter/sediment filter. Which should be in the closed position when the welder is not used for extended periods of time.

ENGINE COOLING SYSTEM

⚠ WARNING

Air to cool the engine is drawn in the side and exhausted through radiator & case back. It is important that the intake and exhaust air is not restricted. Allow a minimum clearance of 1ft. (0.6m) from the case back and 16in.(406mm) from either side of the base to a vertical surface.

⚠ CAUTION

BATTERY CONNECTION

Use caution as the electrolyte is a strong acid that can burn skin and damage eyes.

The VANTAGE® 400 is shipped with the negative battery cable disconnected. Make certain that the RUN-STOP switch is in the STOP position. Remove the two screws from the battery tray using a screwdriver or a 3/8" socket. Attach the negative battery cable to the negative battery terminal and tighten using a 1/2" socket or wrench.

NOTE: This machine is furnished with a wet charged battery; if unused for several months, the battery may require a booster charge. Be careful to charge the battery with the correct polarity. (See ***Battery*** in ***Maintenance Section***)

MUFFLER OUTLET PIPE

Using the clamp provided secure the outlet pipe to the outlet tube with the pipe positioned such that it will direct the exhaust in the desired direction. Tighten using a 9/16" socket or wrench.

SPARK ARRESTER

Some federal, state or local laws may require that gasoline or diesel engines be equipped with exhaust spark arresters when they are operated in certain locations where unarrested sparks may present a fire hazard. The standard muffler included with this welder does not qualify as a spark arrester. When required by local regulations, a suitable spark arrester, such as the K903-1 must be installed and properly maintained.

⚠ WARNING

An incorrect spark arrestor may lead to damage to the engine or adversely affect performance.

REMOTE CONTROL

The VANTAGE® 400 is equipped with a 6-pin and a 14-pin connector. The 6-pin connector is for connecting the K857 or K857-1 Remote Control or for TIG welding, the K870 foot Amptrol or the K936-3 hand Amptrol. When in the CC-STICK, DOWNHILL PIPE, or CV-WIRE modes and when a remote control is connected to the 6-pin Connector, the auto-sensing circuit automatically switches the OUTPUT control from control at the welder to remote control.

When in TOUCH START TIG mode and when a Amptrol is connected to the 6-Pin Connector, the OUTPUT dial is used to set the maximum current range of the CURRENT CONTROL of the Amptrol.

The 14-pin connector is used to directly connect a wire feeder control cable. In the CV-WIRE mode, when the control cable is connected to the 14-pin connector, the auto-sensing circuit automatically makes the Output Control inactive and the wire feeder voltage control active

⚠ WARNING

NOTE: When a wire feeder with a built in welding voltage control is connected to the 14-pin connector, do not connect anything to the 6-pin connector.

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ELECTRICAL CONNECTIONS

MACHINE GROUNDING

Because this portable engine driven welder creates its own power, it is not necessary to connect its frame to an earth ground, unless the machine is connected to premises wiring (home, shop, etc.)

To prevent dangerous electric shock, other equipment to which this engine driven welder supplies power must:

⚠ WARNING

- **Be grounded to the frame of the welder using a grounded type plug or be double insulated.**
- **Do not ground the machine to a pipe that carries explosive or combustible material.**

When this welder is mounted on a truck or trailer, its frame must be electrically bonded to the metal frame of the vehicle. Use a #8 or larger copper wire connected between the machine grounding stud and the frame of the vehicle. When this engine driven welder is connected to premises wiring such as that in a home or shop, its frame must be connected to the system earth ground. See further connection instructions in the section entitled ***Standby Power Connections*** as well as the article on grounding in the latest National Electrical Code and the local code.

In general, if the machine is to be grounded, it should be connected with a #8 or larger copper wire to a solid earth ground such as a metal water pipe going into the ground for at least ten feet and having no insulated joints, or to the metal framework of a building which has been effectively grounded.

The National Electrical Code lists a number of alternate means of grounding electrical equipment. A machine grounding stud marked with the symbol is provided on the front of the welder.

WELDING TERMINALS

The VANTAGE® 400 is equipped with a toggle switch for selecting "hot" welding terminal when in the "WELD TERMINALS ON" position or "cold" welding terminal when in the "REMOTELY CONTROLLED" position.

WELDING OUTPUT CABLES

With the engine off connect the electrode and work cables to the output studs. The welding process dictates the polarity of the electrode cable. These connections should be checked periodically and tightened with a 3/4" wrench.

Table A.1 lists recommended cable sizes and lengths for rated current and duty cycle. Length refers to the distance from the welder to the work and back to the welder. Cable diameters are increased for long cable lengths to reduce voltage drops.

TABLE A.1

TOTAL COMBINED LENGTH OF ELECTRODE AND WORK CABLES	
Cable Length	**Cable Size for 400 Amps 60% Duty Cycle**
0-100 Ft. (0-30 meters)	**2 / 0 AWG**
100-150 Ft. (30-46 meters)	**2 / 0 AWG**
150-200 Ft. (46-61 meters)	**3 / 0 AWG**

CABLE INSTALLATION

Install the welding cables to your VANTAGE® 400 as follows.

1. The engine must be OFF to install welding cables.
2. Remove the flanged nuts from the output terminals .
3. Connect the electrode holder and work cables to the weld output terminals. The terminals are identified on the case front.
4. Tighten the flanged nuts securely.
5. Be certain that the metal piece you are welding (the “work”) is properly connected to the work clamp and cable.
6. Check and tighten the connections periodically.

⚠ CAUTION

- **Loose connections will cause the output terminals to overheat. The terminals may eventually melt.**
- **Do not cross the welding cables at the output terminal connection. Keep the cables isolated and separate from one another.**

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AUXILIARY POWER RECEPTACLES

Start the engine and set the "IDLER" control switch to the "High Idle" mode. Voltage is now correct at the receptacles for auxiliary power. This must be done before a tripped GFCI receptacle can be reset properly. See the MAINTENANCE section for more detailed information on testing and resetting the GFCI receptacle.

The auxiliary power of the VANTAGE® 400 consists of two 20 Amp-120 VAC (5-20R) duplex receptacles with GFCI protection, one 50 Amp 120/240 VAC (14-50R) receptacle and one 50 Amp 240VAC Three-Phase (15-50R) receptacle.

The auxiliary power capacity is 12,000 watts Peak, 11,000 Watts Continuous of 60 Hz, single phase power. The auxiliary power capacity rating in watts is equivalent to volt-amperes at unity power factor. The max permissible current of the 240 VAC output is 50amps.

The 240 VAC output can be split to provide two separate 120 VAC outputs with a max permissible current of 50 Amps per output to two separate 120 VAC branch circuits (these circuits cannot be paralleled). Output voltage is within ± 10% at all loads up to rated capacity.

The Three-Phases auxiliary power capacity is 17,000 watts peak, 19,000 watts continuous. The maximum current is 45 amps.

120 V GFCI DUPLEX RECEPTACLES

A GFCI (Ground Fault Circuit Interrupter) electrical receptacle is a device to protect against electric shock should a piece of defective equipment connected to it develop a ground fault. If this situation should occur, the GFCI will trip, removing voltage from the output of the receptacle. If a GFCI receptacle is tripped see the MAINTENANCE section for detailed information on testing and resetting it. A GFCI receptacle should be properly tested at least once every month.

The 120 V auxiliary power receptacles should only be used with three wire grounded type plugs or approved double insulated tools with two wire plugs. The current rating of any plug used with the system must be at least equal to the current capacity of the associated receptacle.

NOTE: The 240 V receptacle has two 120 V circuits, but are of opposite polarities and cannot be paralleled.

All auxiliary power is protected by circuit breakers. The 120V has 20 Amp circuit breakers for each duplex receptacle. The 120/240V Single Phase and the 240V Three-Phase have a 50 Amp 3-pole Circuit Breaker that disconnects both hot leads and all three phases simultaneously.

STANDBY POWER CONNECTIONS

The VANTAGE® 400 is suitable for temporary, standby or emergency power using the engine manufacturer's recommended maintenance schedule.

The VANTAGE® 400 can be permanently installed as a standby power unit for 240 VAC, 3 wire, single phase, 50 amp service. Connections must be made by a licensed electrician who can determine how the 120/240 VAC power can be adapted to the particular installation and comply with all applicable electrical codes.

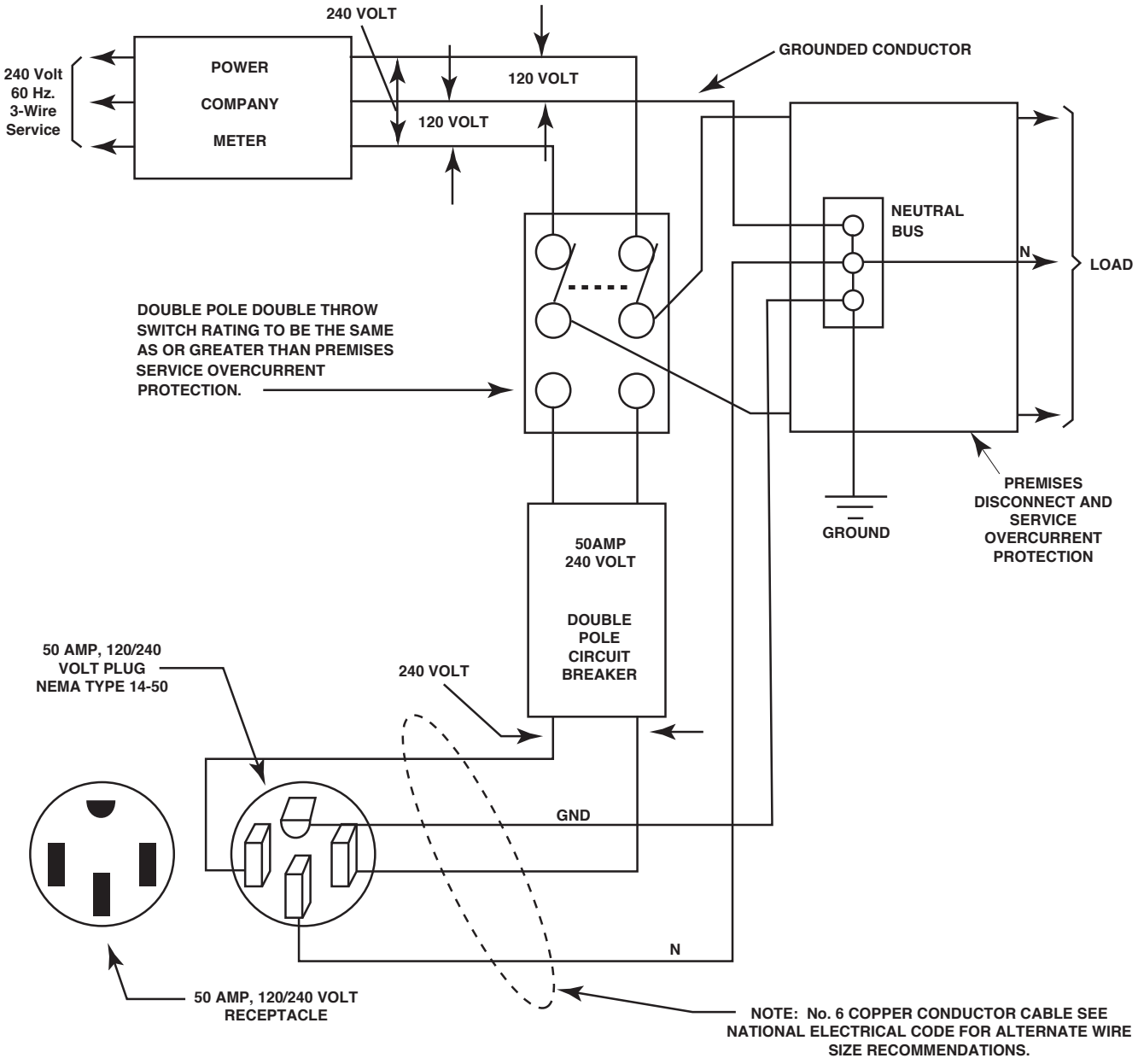
- Install the double-pole, double-throw switch between the power company meter and the premises disconnect. Switch rating must be the same or greater than the customer's premises disconnect and service over current protection.

- Take necessary steps to assure load is limited to the capacity of the generator by installing a 50 amp, 240 VAC double pole circuit breaker. Maximum rated load for each leg of the 240 VAC auxiliary is 50 amperes. Loading above the rated output will reduce output voltage below the allowable - 10% of rated voltage which may damage appliances or other motor-driven equipment and may result in overheating of the engine and/or alternator windings.

- Install a 50 amp, 120/240 VAC plug (NEMA Type 14-50P) to the double-pole circuit breaker using No. 6, 4 conductor cable of the desired length. (The 50 amp, 120/240 VAC plug is available in the optional K802R plug kit or as part number T12153-9.)

- Plug this cable into the 50 Amp, 120/240 Volt receptacle on the case front.

CONNECTION OF VANTAGE® 400 TO PREMISES



⚠ WARNING

- Only a licensed, certified, trained electrician should install the machine to a premises or residential electrical system. Be certain that:
- The installation complies with the National Electrical Code and all other applicable electrical codes.
- The premises is isolated and no feedback into the utility system can occur. Certain state and local laws require the premises to be isolated before the generator is linked to the premises. Check your state and local requirements.
- A double pole, double throw transfer switch in conjunction with the properly rated double throw circuit breaker is connected between the generator power and the utility meter.

CONNECTION OF LINCOLN ELECTRIC WIRE FEEDERS

CONNECTION OF LN-7 OR LN-8 TO THE VANTAGE® 400

1. **Shut the welder off.**
2. Connect the LN-7 or LN-8 per instructions on the appropriate connection diagram in Section F.
3. Set the "WIRE FEEDER VOLTMETER" switch to either "+" or "-" as required by the electrode being used.
4. Set the "MODE" switch to the "CV WIRE " position.
5. Set the "ARC CONTROL" knob to "0" initially and adjust to suit.
6. Set the "WELD TERMINALS" switch to the "REMOTELY CONTROLLED" position.
7. Set the "IDLE" switch to the "HIGH" position.

CONNECTION OF LN-15 TO THE VANTAGE® 400

1. **Shut the welder off.**
2. For electrode Positive, connect the electrode cable to the "+" terminal of the welder and work cable to the "-" terminal of the welder. For electrode Negative, connect the electrode cable to the "-" terminal of the welder and work cable to the "+" terminal of the welder.
3. **Across The-Arc Model:**
   - Attach the single lead from the front of the LN-15 to work using the spring clip at the end of the lead. This is a control lead to supply current to the wire feeder motor; it does not carry welding current.
   - Set the "WELD TERMINALS" switch to "WELD TERMINALS ON".
   - When the gun trigger is closed, the current sensing circuit will cause the VANTAGE® 400 engine to go to the high idle speed, the wire will begin to feed and the welding process started. When welding is stopped, the engine will revert to low idle speed after approximately 12 seconds unless welding is resumed.
4. **Control Cable Model:**
   - Connect Control Cable between Engine Welder and Feeder.
   - Set the "WELD TERMINALS" switch to "REMOTELY CONTROLLED"
   - Set the MODE switch to the "CV-WIRE " position.
   - Set the "WIRE FEEDER VOLTMETER" switch to either "+" or "-" as required by the electrode polarity being used.
   - Set the "ARC CONTROL" knob to "0" initially and adjust to suit.
   - Set the "IDLE" switch to the "AUTO" position.
   - When the gun trigger is closed, the current sensing circuit will cause the VANTAGE® 400 engine to go to the high idle speed, the wire will begin to feed and the welding process started. When welding is stopped, the engine will revert to low idle speed after approximately 12 seconds unless welding is resumed.

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⚠ WARNING

Connection of the LN-25 to the VANTAGE® 400
Shut off welder before making any electrical connections.

The LN-25 with or without an internal contactor may be used with the VANTAGE® 400. See the appropriate connection diagram in Section F.

NOTE: The LN-25 (K431) Remote Control Module and (K432) Remote Cable are not recommended for use with the VANTAGE® 400.

1. **Shut the welder off.**
2. For electrode Positive, connect the electrode cable from the LN-25 to the "+" terminal of the welder and work cable to the "-" terminal of the welder. For electrode Negative, connect the electrode cable from the LN-25 to the "-" terminal of the welder and work cable to the "+" terminal of the welder.
3. Attach the single lead from the front of the LN-25 to work using the spring clip at the end of the lead. This is a control lead to supply current to the wire feeder motor; it does not carry welding current.
4. Set the MODE switch to the "CV-WIRE " position.
5. Set the "WELD TERMINALS" switch to "WELD TERMINALS ON"
6. Set the "ARC CONTROL" knob to "0" initially and adjust to suit.
7. Set the "IDLE" switch to the "AUTO" position. When not welding, the VANTAGE® 400 engine will be at the low idle speed. If you are using an LN-25 with an internal contactor, the electrode is not energized until the gun trigger is closed.
8. When the gun trigger is closed, the current sensing circuit will cause the VANTAGE® 400 engine to go to the high idle speed, the wire will begin to feed and the welding process started. When welding is stopped, the engine will revert to low idle speed after approximately 12 seconds unless welding is resumed.

⚠ CAUTION

If you are using an LN-25 without an internal contactor, the electrode will be energized when the VANTAGE® 400 is started.

CONNECTION OF SPOOL GUN (K487-25) AND COBRAMATIC TO VANTAGE® 400

- **Shut the welder off.**
- ***Connect per instructions on the appropriate connection diagram in Section C.***

CONNECTION OF PRINCE XL SPOOL GUN TO THE VANTAGE® 400

Connection of the Prince XL Spool Gun requires the use of the K1849-1 Adapter Module.

- **Shut the Welder off.**
- For electrode Positive, connect the electrode cable to the "+" terminal of the welder and work cable to the "-" terminal of the welder. For electrode Negative, connect the electrode cable "-" terminal of the welder and work cable to the "+" terminal of the welder.
- Connect the Control Cable of the Spool Gun to the Adapter Module and connect the Control Cable of the Adapter Module to the Welder.
- Connect the Gas Hose.
- Set the MODE switch to the "CV-WIRE " position.
- Set the "WELD TERMINALS" switch to "WELD TERMINALS ON".
- Set the "ARC CONTROL" knob to "0" initially and adjust to suit.
- Set the “IDLE” switch to the “HIGH” position.

See Section C for additional Connection Diagrams.

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SAFETY PRECAUTIONS

⚠ WARNING

Do not attempt to use this equipment until you have thoroughly read the engine manufacturer's manual supplied with your welder. It includes important safety precautions, detailed engine starting, operating and maintenance instructions, and parts lists.

ELECTRIC SHOCK can kill.

- **Do not touch electrically live parts or electrode with skin or wet clothing.**
- **Insulate yourself from work and ground**
- **Always wear dry insulating gloves.**

- **Always operate the welder with the hinged door closed and the side panels in place.**

- **Read carefully the Safety Precautions page before operating this machine. Always follow these and any other safety procedures included in this manual and in the Engine Instruction Manual.**

GENERAL DESCRIPTION

The VANTAGE® 400 is a diesel engine powered DC multi-process welding power source and 120 / 240 volt AC power generator. The engine drives a generator that supplies three phase power for the DC welding circuit, single phase and Three Phase power for the AC auxiliary outlets. The DC welding control system uses state of the art Chopper Technology (CT™) for superior welding performance.

The Vantage® 400 is fitted with a selectable VRD(Voltage Reduction Device). The VRD operates in the CC-Stick mode reducing the OCV to <13 volts, increasing operator safety when welding is performed in environments with increased hazard of electric shock.

FOR AUXILIARY POWER:

Start the engine and set the IDLER control switch to the desired operating mode. Full power is available regardless of the welding control settings providing no welding current is being drawn.

ENGINE OPERATION

Before Starting the Engine:

- Be sure the machine is on a level surface.
- Open side engine door and remove the engine oil dipstick and wipe it with a clean cloth. Reinsert the dipstick and check the level on the dipstick.
- Add oil (if necessary) to bring the level up to the full mark. Do not overfill. Close engine door.
- Check radiator for proper coolant level. (Fill if necessary).
- See Engine Owner's Manual for specific oil and coolant recommendations.

⚠ WARNING

ADD FUEL

DIESEL FUEL can cause fire.

- **Stop engine while fueling.**
- **Do not smoke when fueling.**
- **Keep sparks and flame away from tank.**
- **Do not leave unattended while fueling.**
- **Wipe up spilled fuel and allow fumes to clear before starting engine.**
- **Do not overfill tank, fuel expansion may cause overflow.**

DIESEL FUEL ONLY

- Remove the fuel tank cap.

- Fill the tank. DO NOT FILL THE TANK TO THE POINT OF OVERFLOW.

- Replace the fuel cap and tighten securely.

- See Engine Owner's Manual for specific fuel recommendations.

BREAK-IN PERIOD

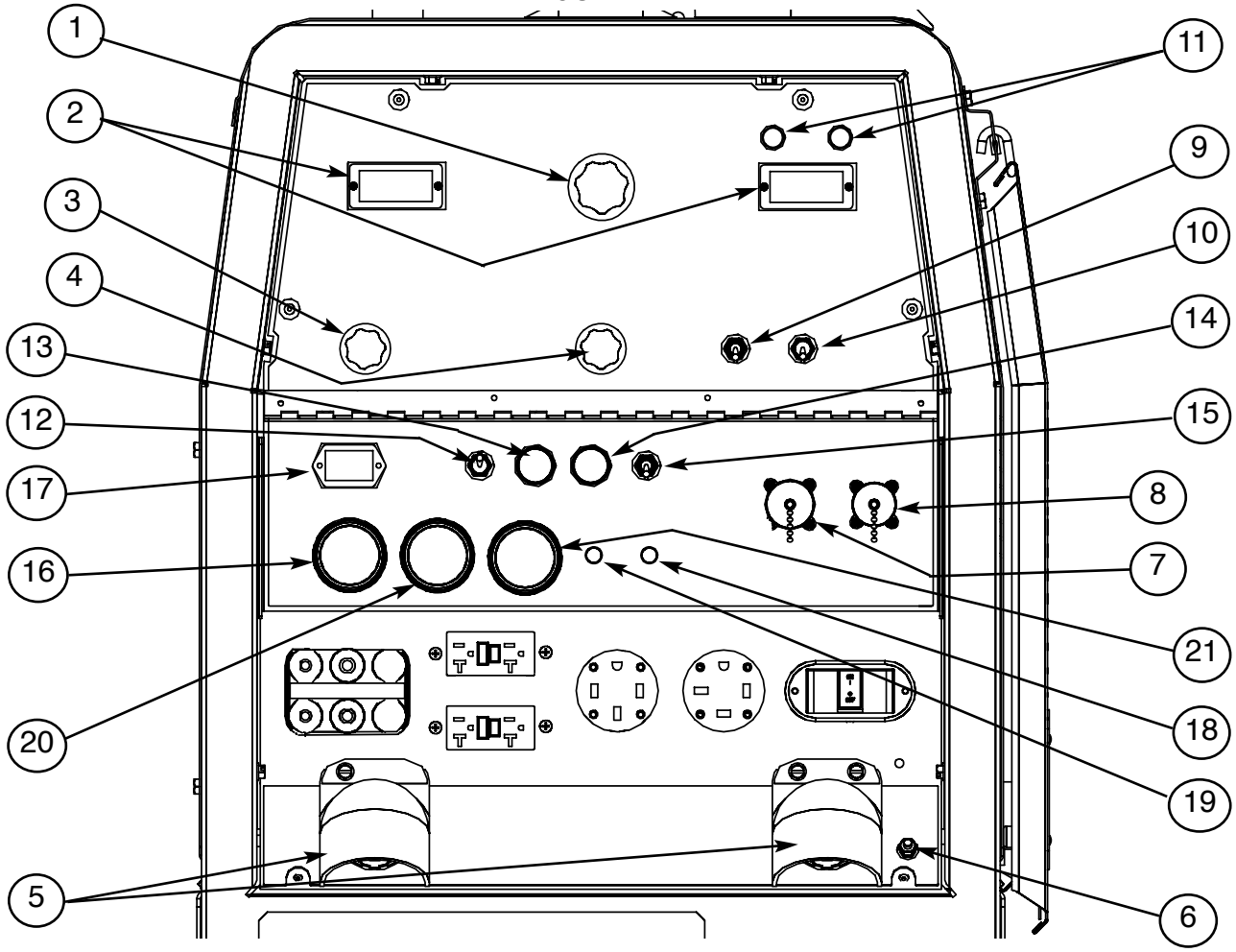
⚠ CAUTION

The engine will use a small amount of oil during its "break-in" period. The break-in period is about 50 running hours.

Check the oil every four hours during break-in. Change the oil after the first 50 hours of operation and every 200 hours thereafter. Change the oil filter at each oil change.

During break-in, subject the Welder to moderate loads. Avoid long periods running at idle. Before stopping the engine, remove all loads and allow the engine to cool several minutes.

FIGURE B.1



WELDING CONTROLS (Figure B.1)

1. OUTPUT CONTROL- The OUTPUT dial is used to preset the output voltage or current as displayed on the digital meters for the four welding modes. When in the CC-STICK, DOWNHILL PIPE or CV-WIRE modes and when a remote control is connected to the 6-Pin or 14-Pin Connector, the auto-sensing circuit automatically switches the OUTPUT CONTROL from control at the welder to the remote control.

In the CV-WIRE mode, if the feeder being used has a voltage control when the wire feeder control cable is connected to the 14-Pin Connector, the auto-sensing circuit automatically makes OUTPUT CONTROL inactive and the wire feeder voltage control active. Otherwise, the OUTPUT CONTROL is used to preset the voltage

When in the TOUCH START TIG mode and when an Amptrol is connected to the 6-Pin Connector, the OUTPUT dial is used to set the maximum current range of the CURRENT CONTROL of the Amptrol.

2. DIGITAL OUTPUT METERS-The digital meters allow the output voltage (CV-WIRE mode) or current (CC-STICK,DOWN HILL PIPE and TIG modes) to be set prior to welding using the OUTPUT control dial. During welding, the meter display the actual output voltage (VOLTS) and current (AMPS). A memory feature holds the display of both meters on for seven seconds after welding is stopped. This allows the operator to read the actual current and voltage just prior to when welding was ceased.

While the display is being held the left-most decimal point in each display will be flashing. The accuracy of the meters is +/- 3%.

3. WELD MODE SELECTOR SWITCH-
(Provides four selectable welding modes)
CV-WIRE
DOWNHILL PIPE
CC-STICK
TOUCH START TIG

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4. ARC CONTROL- The ARC CONTROL dial is active in the CV-WIRE, CC-STICK and DOWNHILL PIPE modes, and has different functions in these modes. This control is not active in the TIG mode.

CC-STICK mode: In this mode, the ARC CONTROL dial sets the short circuit current (arc-force) during stick welding to adjust for a soft or crisp arc. Increasing the dial from –10 (soft) to +10 (crisp) increases the short circuit current and prevents sticking of the electrode to the plate while welding. This can also increase spatter. It is recommended that the ARC CONTROL be set to the minimum number without electrode sticking. Start with a setting at 0.

DOWNHILL PIPE mode: In this mode, the ARC CONTROL dial sets the short circuit current (arc-force) during stick welding to adjust for a soft or a more forceful digging arc (crisp). Increasing the number from –10 (soft) to +10 (crisp) increases the short circuit current which results in a more forceful digging arc. Typically a forceful digging arc is preferred for root and hot passes. A softer arc is preferred for fill and cap passes where weld puddle control and deposition ("stacking" of iron) are key to fast travel speeds. It is recommended that the ARC CONTROL be set initially at 0.

CV-WIRE mode: In this mode, turning the ARC CONTROL clock wise from –10 (soft) to +10 (crisp) changes the arc from soft and washed-in to crisp and narrow. It acts as an inductance/pinch control. The proper setting depends on the procedure and operator preference. Start with a setting of 0.

5. WELD OUTPUT TERMINALS WITH FLANGE NUT- Provides a connection point for the electrode and work cables.

6. GROUND STUD- ⏚ Provides a connection point for connecting the machine case to earth ground.

7. 14-PIN CONNECTOR- For attaching wire feeder control cables. Includes contactor closure circuit, auto-sensing remote control circuit, and 120V and 42V power. The remote control circuit operates the same as the 6 Pin Amphenol.

8. 6-PIN CONNECTOR- For attaching optional remote control equipment. Includes auto-sensing remote control circuit.

9. WELD TERMINALS CONTROL SWITCH- In the WELD TERMINALS ON position, the output is electrically hot all the time. In the REMOTELY CONTROLLED position, the output is controlled by a wire feeder or amptrol device, and is electrically off until a remote switch is depressed.

10. WIRE FEEDER VOLTMETER SWITCH: Matches the polarity of the wire feeder voltmeter to the polarity of the electrode.

11. VRD (Voltage Reduction Device) INDICATOR LIGHTS- On the front panel of the Vantage 400 are two indicator lights. A red light when lit indicates OCV(Open Circuit Voltage) is equal to or greater than 30V and a green light when lit indicates OCV(Open Circuit Voltage) is less than 30V.

The VRD "On/Off" switch inside the control panel must be "On" for the VRD function to be active and the lights to be enabled. When the machine is first started with VRD enabled, both lights will illuminate for 5 seconds.

These lights monitor the OCV(Open Circuit Voltage) and weld voltage at all times. In the CC-Stick mode when not welding the green light will illuminate indicating that the VRD has reduced the OCV to less than 30V. During welding the red light will illuminate whenever the arc voltage is equal to or greater than 30V. This means that the red and green light may alternate depending on the weld voltage. This is normal operation.

If the red light remains illuminated when not welding in the CC-stick mode, the VRD is not functioning properly. Please refer to your local field service shop for service.

If the VRD is turned "On" and the lights don't come "On", refer to the trouble shooting section.

TABLE B.1

VRD INDICATOR LIGHTS			
MODE		VRD "ON"	VRD "OFF"
CC-STICK	OCV	Green (OCV Reduced)	No Lights
	While Welding	Red or Green (Depends on Weld Voltage) *	
CV-WIRE	OCV	Red (OCV Not Reduced) Weld Terminals On	
		Red (OCV Not Reduced) Weld Terminals Remotely Controlled Gun Trigger Closed	
		Green (No OCV) Weld Terminals Remotely Controlled Gun Trigger Open	
	While Welding	Red or Green (Depends on Weld Voltage) *	
PIPE	OCV	Green (No Output)	
	While Welding	Not Applicable (No Output)	
ARC GOUGING	OCV	Green (No Output)	
	While Welding	Not Applicable (No Output)	
TIG	OCV	Green (Process is Low Voltage)	
	While Welding	Green (Process is Low Voltage)	

* It is normal for the lights to alternate between colors while welding.

ENGINE CONTROLS:

12. RUN/STOP SWITCH - RUN position energizes the engine prior to starting. STOP position stops the engine. The oil pressure interlock switch prevents battery drain if the switch is left in the RUN position and the engine is not operating.

13. GLOW PLUG PUSH BUTTON -

- When pushed activates the glow plugs. Glow plug should not be activated for more than 20 seconds continuously.

14. START PUSH BUTTON - Energizes the starter motor to crank the engine.

15. IDLER SWITCH- Has two positions as follows:

1) In the HIGH position, the engine runs at the high idle speed controlled by the engine governor.
2) In the AUTO position, the idler operates as follows:

- When switched from HIGH to AUTO or after starting the engine, the engine will operate at full speed for approximately 12 seconds and then go to low idle speed.
- When the electrode touches the work or power is drawn for lights or tools (approximately 100 Watts minimum), the engine accelerates and operates at full speed.
- When welding ceases or the AC power load is turned off, a fixed time delay of approximately 12 seconds starts. If the welding or AC power load is not restarted before the end of the time delay, the idler reduces the engine speed to low idle speed.
- The engine will automatically return to high idle speed when there is welding load or AC power load reapplied.

16. ELECTRIC FUEL GAUGE- The electric fuel gauge gives accurate and reliable indication as to how much fuel is in the fuel tank.

17. ENGINE HOUR METER- Displays the total time that the engine has been running. This meter is useful for scheduling prescribed maintenance.

TABLE B.2

TYPICAL VANTAGE® 400 FUEL CONSUMPTION		
	PERKINS Gal./Hr (Liters/Hr)	Running Time for 15 gallons / hours
Low Idle - No Load 1400 R.P.M.	.26 (.97)	58.59
High Idle - No Load 1880 R.P.M.	.42 (1.57)	36.06
DC Weld Output 400 Amps @ 36 Volts	1.18 (4.46)	12.74
17,000 Watts 3 Phase	1.24 (4.68)	12.14
11,000 Watts 1 Phase	.90 (3.42)	16.62

NOTE: This data is for reference only. Fuel consumption is approximate and can be influenced by many factors, including engine maintenance, environmental conditions and fuel quality.

18. ENGINE PROTECTION LIGHT- A warning indicator light for Low Oil Pressure and/or Coolant Over Temperature.The light is off when the systems are functioning properly. The light will come on and the engine will shutdown when there is Low Oil Pressure and/or the Coolant is Over Temperature.

Note: The light remains off when the RUN-STOP switch is in the "ON" position prior to starting the engine. However if the engine is not started within 60 seconds the light will come on. When this happens the RUN-STOP switch must be returned to the "OFF" position to reset the engine protection system and light.

19. BATTERY CHARGING LIGHT- A warning indicator light for Low/No battery charge. The light is off when the systems are functioning properly. The light will come on if there is a Low/No battery condition but the machine will continue to run.

Note: The light may or may not come on when the RUN-STOP switch is in the "ON" position. It will come on during cranking and stay on until the engine starts. After starting the engine the light will go off unless a Low/No battery charge condition exists.

20. COOLANT TEMPERATURE GAUGE-A indicator of engine coolant temperature.

21. OIL PRESSURE GAUGE- A indicator of engine Oil Pressure.

STARTING THE ENGINE

1. Remove all plugs connected to the AC power receptacles.
2. Set IDLER switch to AUTO.
3. Press Glow Plug Button and hold 15 to 20 seconds.
4. Set the RUN/STOP switch to RUN.
5. Press START button until the engine starts or for up to 10 seconds. Continue to hold the glow plug button for up to an additional 10 seconds.
6. Release the engine START button immediately when the engine starts.
7. The engine will run at high idle speed for approximately 12 seconds and then drop to low idle speed. Allow the engine to warm up at low idle for several minutes before applying a load and/or switching to high idle. Allow a longer warm up time in cold weather.

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NOTE: If the unit fails to start turn Run/Stop switch to off and repeat step 3 through step 7 after waiting 30 seconds.

⚠ CAUTION

- **Do not allow the starter motor to run continuously for more than 20 seconds.**
- **Do not push the START button while the engine is running because this can damage the ring gear and/or the starter motor.**
- **IF the Engine Protection or Battery Charging Lights do "not" turn off shortly after starting the engine shut off the engine immediately and determine the cause.**

NOTE: When starting for the first time, or after an extended period of time of not operating, it will take longer than normal to start because the fuel pump has to fill the fuel system. For best results, bleed the fuel system as indicated in the Maintenance Section of this manual.

STOPPING THE ENGINE

Remove all welding and auxiliary power loads and allow the engine to run at low idle speed for a few minutes to cool the engine.

STOP the engine by placing the RUN-STOP switch in the STOP position.

NOTE: A fuel shut off valve is located on the fuel prefilter.

WELDER OPERATION

DUTY CYCLE

Duty Cycle is the percentage of time the load is being applied in a 10 minute period. For example a 60% duty cycle, represents 6 minutes of load and 4 minutes of no load in a 10 minute period.

ELECTRODE INFORMATION

For any electrode the procedures should be kept within the rating of the machine. For information on electrodes and their proper application see (www.lincolnelectric.com) or the appropriate Lincoln publication.

The VANTAGE® 400 can be used with a broad range of DC stick electrodes. The MODE switch provides two stick welding settings as follows:

CONSTANT CURRENT (CC-STICK) WELDING

The CC-STICK position of the MODE switch is designed for horizontal and vertical-up welding with all types of electrodes, especially low hydrogen. The OUTPUT CONTROL dial adjusts the full output range for stick welding.

The ARC CONTROL dial sets the short circuit current (arc-force) during stick welding to adjust for a soft or crisp arc. Increasing the number from -10(soft) to +10(crisp) increases the short circuit current and prevents sticking of the electrode to the plate while welding. This can also increase spatter. It is recommended that the ARC CONTROL be set to the minimum number without electrode sticking. Start with the dial set at 0.

NOTE: Due to the low OCV with the VRD on, a very slight delay during striking of the electrodes may occur. Due to the requirement of the resistance in the circuit to be low for a VRD to operate, a good metal-to-metal contact must be made between the metal core of the electrode and the job. A poor connection anywhere in the welding output circuit may limit the operation of the VRD. This includes a good connection of the work clamp to the job. The work clamp should be connected as close as practical to where the welding will be performed.

A. For New Electrodes

E6010 - Touch, Lift to Start the Arc

E7018, E7024 - Touch, Rock Back and Forth in Joint, Lift .

Once the arc is started, normal welding technique for the application is then used.

B. For Re-Striking Electrodes

Some electrodes form a cone at the end of the electrode after the welding arc has been broken, particularly iron powder and low hydrogen electrodes. This cone will need to be broken off in order to have the metal core of the electrode make contact.

E6010 - Push, Twist in Joint, Lift

E7018, E7024 - Push, Rock Back and Forth in Joint, Lift.

Once the arc is started, normal welding technique for the application is then used.

For other electrodes the above techniques should be tried first and varied as needed to suit operator preference. The goal for successful starting is good metal to metal contact.

For indicator light operation, ***see Table B.1.***

DOWNHILL PIPE Welding

This slope controlled setting is intended for "out-of-position" and "down hill" pipe welding where the operator would like to control the current level by changing the arc length.

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The OUTPUT CONTROL dial adjusts the full output range for pipe welding.

The ARC CONTROL dial sets the short circuit current (arc-force) during stick welding to adjust for a soft or more forceful digging arc (crisp). Increasing the number from -10(soft) to +10(crisp) increases the short circuit current which results in a more forceful digging arc.

Typically a forceful digging arc is preferred for root and hot passes. A softer arc is preferred for fill and cap passes where weld puddle control and deposition ("stacking" of iron) are key to fast travel speeds. This can also increase spatter.

It is recommended that the ARC CONTROL be set to the minimum number without electrode sticking. Start with the dial set at 0.

NOTE: With the VRD switch in the "ON" position there is no output in the DOWNHILL PIPE mode. For indicator light operation, ***see Table B.1.***

TIG WELDING

The TOUCH START TIG setting of the MODE switch is for DC TIG (Tungsten Inert Gas) welding. To initiate a weld, the OUTPUT CONTROL dial is first set to the desired current and the tungsten is touched to the work. During the time the tungsten is touching the work there is very little voltage or current and, in general, no tungsten contamination. Then, the tungsten is gently lifted off the work in a rocking motion, which establishes the arc.

When in the TOUCH START TIG mode and when a Amptrol is connected to the 6-Pin connector the OUTPUT CONTROL dial is used to set the maximum current range of the current control of the Amptrol.

The ARC CONTROL is not active in the TIG mode. To STOP a weld, simply pull the TIG torch away from the work.
When the arc voltage reaches approximately 30 Volts the arc will go out and the machine will reset the current to the Touch Start level.

To reinitiate the arc, retouch the tungsten to the work and lift. Alternatively, the weld can be stopped by releasing the Amptrol or arc start switch.

The VANTAGE® 400 can be used in a wide variety of DC TIG welding applications. In general the 'Touch Start' feature allows contamination free starting without the use of a Hi-frequency unit. If desired, the K930-2 TIG Module can be used with the VANTAGE® 400. The settings are for reference.

VANTAGE® 400 settings when using the K930-2 TIG Module with an Amptrol or Arc Start Switch:

- Set the MODE Switch to the TOUCH START TIG setting.
- Set the "IDLER" Switch to the "AUTO" position.

TABLE B.3

TYPICAL CURRENT RANGES (1) FOR TUNGSTEN ELECTRODES(2)

Tungsten Electrode Diameter in. (mm)		DCEN (-)	DCEP (+)	Approximate Argon Gas Flow Flow Rate C.F.H. (l /min.)				TIG TORCH Nozzle Size (4), (5)
		1%, 2% Thoriated Tungsten	1%, 2% Thoriated Tungsten	Aluminum		Stainless Steel		
0.010	(.25)	2-15	(3)	3-8	(2-4)	3-8	(2-4)	#4, #5, #6
0.020	(.50)	5-20	(3)	5-10	(3-5)	5-10	(3-5)	
0.040	(1.0)	15-80	(3)	5-10	(3-5)	5-10	(3-5)	
1/16	(1.6)	70-150	10-20	5-10	(3-5)	9-13	(4-6)	#5, #6
3/32	(2.4)	150-250	15-30	13-17	(6-8)	11-15	(5-7)	#6, #7, #8
1/8	(3.2)	250-400	25-40	15-23	(7-11)	11-15	(5-7)	
5/32	(4.0)	400-500	40-55	21-25	(10-12)	13-17	(6-8)	#8, #10
3/16	(4.8)	500-750	55-80	23-27	(11-13)	18-22	(8-10)	
1/4	(6.4)	750-1000	80-125	28-32	(13-15)	23-27	(11-13)	

(1) When used with argon gas. The current ranges shown must be reduced when using argon/helium or pure helium shielding gases.
(2) Tungsten electrodes are classified as follows by the American Welding Society (AWS):

Pure	EWP
1% Thoriated	EWTh-1
2% Thoriated	EWTh-2

Though not yet recognized by the AWS, Ceriated Tungsten is now widely accepted as a substitute for 2% Thoriated Tungsten in AC and DC applications.
(3) DCEP is not commonly used in these sizes.
(4) TIG torch nozzle "sizes" are in multiples of 1/16ths of an inch:

# 4 = 1/4 in.	(6 mm)
# 5 = 5/16 in.	(8 mm)
# 6 = 3/8 in.	(10 mm)
# 7 = 7/16 in.	(11 mm)
# 8 = _ in.	(12.5 mm)
#10 = 5/8 in.	(16 mm)

(5) TIG torch nozzles are typically made from alumina ceramic. Special applications may require lava nozzles, which are less prone to breakage, but cannot withstand high temperatures and high duty cycles.

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- Set the "WELDING TERMINALS" switch to the "REMOTELY CONTROLLED" position. This will keep the "Solid State" contactor open and provide a "cold" electrode until the Amptrol or Arc Start Switch is pressed.

When using the TIG Module, the OUTPUT CONTROL on the VANTAGE® 400 is used to set the maximum range of the CURRENT CONTROL on the TIG Module or an Amptrol if connected to the TIG Module.

NOTE: The TIG process is to receive a low voltage welding process. There is no difference in operation with the VRD "On" or "Off" for this mode. For indicator light operation, ***see Table B.1.***

WIRE WELDING-CV

Connect a wire feeder to the VANTAGE® 400 according to the instructions in INSTALLATION INSTRUCTIONS Section.

The VANTAGE® 400 in the CV-WIRE mode, permits it to be used with a broad range of flux cored wire (Innershield and Outershield) electrodes and solid wires for MIG welding (gas metal arc welding). Welding can be finely tuned using the ARC CONTROL. Turning the ARC CONTROL clockwise from –10 (soft) to +10 (crisp) changes the arc from soft and washed-in to crisp and narrow. It acts as an inductance/pinch control. The proper setting depends on the procedure and operator preference. Start with the dial set at 0.

NOTE: In the CV-Mode with VRD "On", the OCV(Open Circuit Voltage) is not reduced. For indicator light operation, see ***Table B.1***.

ARC GOUGING

The VANTAGE® 400 can be used for arc gouging. For optimal performance, set the MODE switch to CC-STICK and the ARC CONTROL to +10.

Set the OUTPUT CONTROL knob to adjust output current to the desired level for the gouging electrode being used according to the ratings in the following Table B.4.

TABLE B.4

Carbon Diameter	Current Range (DC, electrode positive)
1/8"	60-90 Amps
5/32"	90-150 Amps
3/16"	200-250 Amps
1/4"	300-400 Amps
5/16"	450-550 Amps

AUXILIARY POWER:

Start the engine and set the IDLER control switch to the desired operating mode. Full power is available regardless of the welding control settings providing no welding current is being drawn.

Simultaneous Welding and Auxiliary Power Loads

The auxiliary power ratings are with no welding load. Simultaneous welding and power loads are specified in the following table.

TABLE B.5

VANTAGE® 400 Simultaneous Welding and Power Loads

Weld Amps		1 PHASE WATTS	1 PHASE AMPS		3 PHASE WATTS	3 PHASE AMPS		BOTH 1 & 3 PHASE WATTS	BOTH 1 & 3 PHASE AMPS
0		11,000	46		17,000	41		11,000	-
100		11,000	46		15,400	37		11,000	-
200	PLUS	8,000	33	OR	13,000	31	OR	8,000	-
300		4700	20		9400	23		4,700	-
400		1700	7		3400	8		1,700	-
500		0	0		0	0		0	0

TABLE B.6

VANTAGE® 400 (CE) Extension Cord Length Recommendations

(Use the shortest length extension cord possible sized per the following table.)

Current	Voltage	Load	Maximum Allowable Cord Length in ft. (m) for Conductor Size											
(Amps)	Volts	(Watts)	14 AWG		12 AWG		10 AWG		8 AWG		6 AWG		4 AWG	
15	120	1800	30	(9)	40	(12)	75	(23)	125	(38)	175	(53)	300	(91)
20	120	2400			30	(9)	50	(15)	88	(27)	138	(42)	225	(69)
15	240	3600	60	(18)	75	(23)	150	(46)	225	(69)	350	(107)	600	(183)
20	240	4800			60	(18)	100	(30)	175	(53)	275	(84)	450	(137)
44	240	9500					50	(15)	90	(27)	150	(46)	225	(69)
Conductor size is based on maximum 2.0% voltage drop.														

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FIELD INSTALLED OPTIONS / ACCESSORIES

K2641-2 FOUR WHEELED STEERABLE YARD TRAILER
For in plant and yard towing. Comes standard with a Duo-Hitch™, a 2" Ball and Lunette Eye combination Hitch.

K2636-1 TRAILER - Two-wheeled trailer with optional fender and light package. For highway use, consult applicable federal, state, and local laws regarding possible additional requirements. Comes standard with a Duo-Hitch™, a 2" Ball and Lunette Eye combination hitch. **Order:**
K2636-1 Trailer
K2639-1 Fender & Light Kit
K2640-1 Cable Storage Rack

K903-1 SPARK ARRESTOR - Includes a heavy gage steel, approved spark arrestor, clamp and adapter for mounting to the muffler exhaust pipe.

K704 ACCESSORY SET - Includes 35 ft. (10m) of electrode cable and 30 ft. (9.1m) of work cable, head shield, work clamp electrode holder. Cables are rated at 400 amps, 100% duty cycle.

K857 25 ft (7.6m) or **K857-1** 100 ft. (30.4m) **REMOTE CONTROL**
Portable control provides same dial range as the output control on the welder. Has a convenient 6 pin plug for easy connection to the welder.

K802N POWER PLUG KIT
Provides four 120 volt plugs rated at 20 amps each and one dual voltage, full KVA plug rated at 120/240 volts, 50 amps.

K802R POWER PLUG KIT
Provides four 120 volt plugs rated at 15 amps each and one dual voltage, full KVA plug rated at 120/240 volts, 50 amps.

T12153-9 50 AMP, 120/240V POWER PLUG (1-Phase)
T12153-10 50 AMP, 240V POWER PLUG (3-Phase)

K1816-1 FULL KVA ADAPTER KIT
Plugs into the 120/240V NEMA 14-50R receptacle on the case front (which accepts 4-prong plugs) and converts it to a NEMA 6-50R receptacle, (which accepts 3-prong plugs.) For connection of Lincoln equipment with NEMA 6-50 Plug.

K1858-1 SERVICE INDICATOR KIT- Provides a GO / NO-GO visual indication of air cleaner element useful service life. Filter service based on restriction readings allows the longest life possible from the filter and best engine protection.

K2679-1 COLD WEATHER HEATER AND TARP KIT
For engine starting and operation in extreme cold weather conditions down to -40ºF / -40ºC (with the use of OW40 synthetic oil and arctic diesel fuel), includes 120VAC engine block heater, and radiator grill tarp.

WIRE FEEDER OPTIONS

K449 LN-25 - Includes internal contactor for across the arc operation (no control cable). Provides "cold" electrode until gun trigger is pressed. Includes gas solenoid.

K1870-1 LN-15 Across the Arc Wire Feeder.
Portable, lightweight, compact CC/CV unit for flux-cored and MIG welding. Includes Gas Solenoid, adjustable flow meter and internal contactor. For 10-15 lb. (4.5-6.8kg) spools.

Magnum Gun and Magnum Gun Connector Kit are required for gas-shielded welding. Innershield Gun is required for gasless welding.

K126-2 Magnum 350 Innershield Gun
K1802-1 Magnum 300 MIG Gun (for LN-25)
K470-2 Magnum 300 MIG Gun (for LN-15, Includes Connector Kit)
K466-10 Connector Kit (for LN-15, K470-2)
K1500-1 Gun Receiver Bushing (for LN-15 & K126-2)

K487-25 Magnum SG Spool Gun
Hand held semiautomatic wire feeder. Requires SG Control Module and Input Cable.

K488 SG Control Module (For Magnum Spool Gun)
The Interface between the power source and the spool gun. Provides control of the wire speed and gas flow. For use with a K487-25 spool gun.

K691-10 Input Cable (For SG Control Module)
For Lincoln engine power sources with 14-pin MS-type connection, separate 115V NEMA receptacles and output stud connections.

Note: See Wire Feeder IM manuals for appropriate Drive Roll and Guide Tubes.

TIG OPTIONS

K1783-9 Pro -Torch® PTA-26V TIG Torch
Air Cooled 200 amp torch (2 piece) equipped with valve for gas flow control. 25 ft. (7.6m) length.

KP509 Magnum Parts Kit for PTA-26V TIG Torch
Magnum Parts Kit provides all the torch accessories you need to start welding. Parts kit provides collets, collet bodies, a black cap, alumina nozzles and tungstens in a variety of sizes, all packaged in an easy to carry reclosable sack.

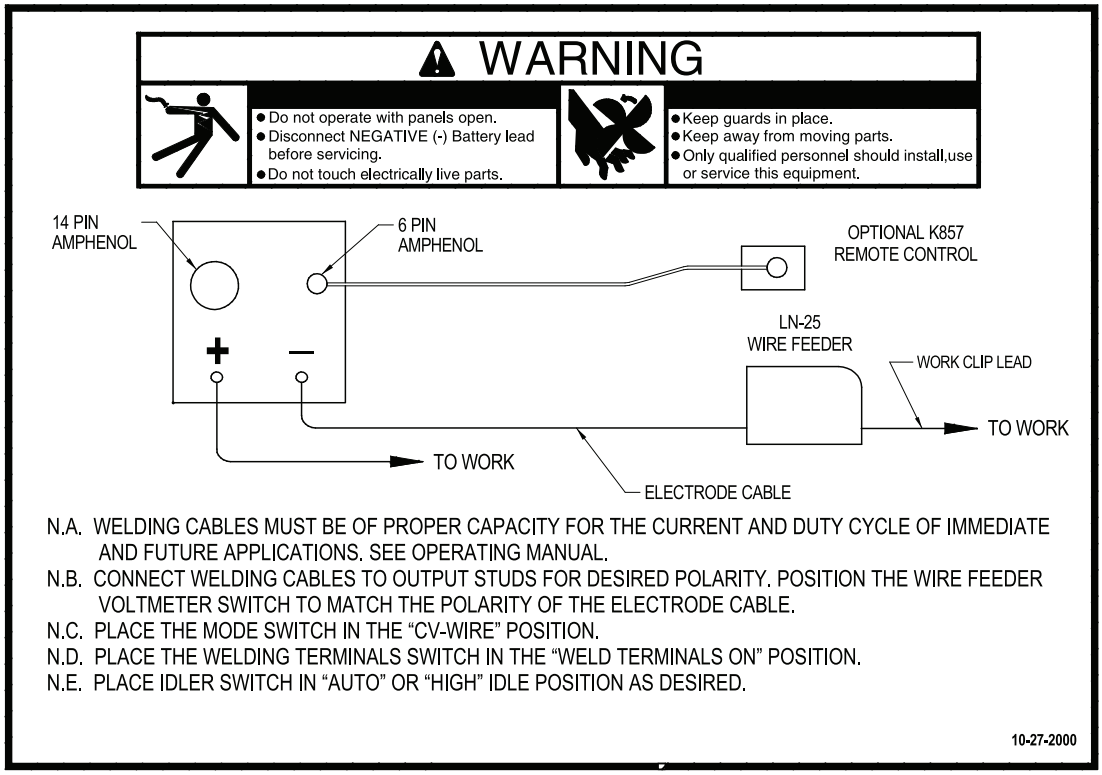
K870 Foot Amptrol®
K963-3 Hand Amptrol®
K2347-1 Precision TIG 185 Ready-Pak(For AC TIG)

K2350-1 Invertec® V205-T AC/DC One-Pak™ Package (For AC TIG)

PLASMA CUTTING

K1580-1 Pro-Cut 55
Cuts metal using the 3-phase AC generator power from the engine driven welder. Accepts 3-phase or 1-phase input power. Requires the K1816-1 Full KVA adapter kit, if connected for 1-phase input power.

ENGINE WELDERS /LN-25 ACROSS THE ARC CONNECTION DIAGRAM WITH OPTIONAL K857 REMOTE CONTROL



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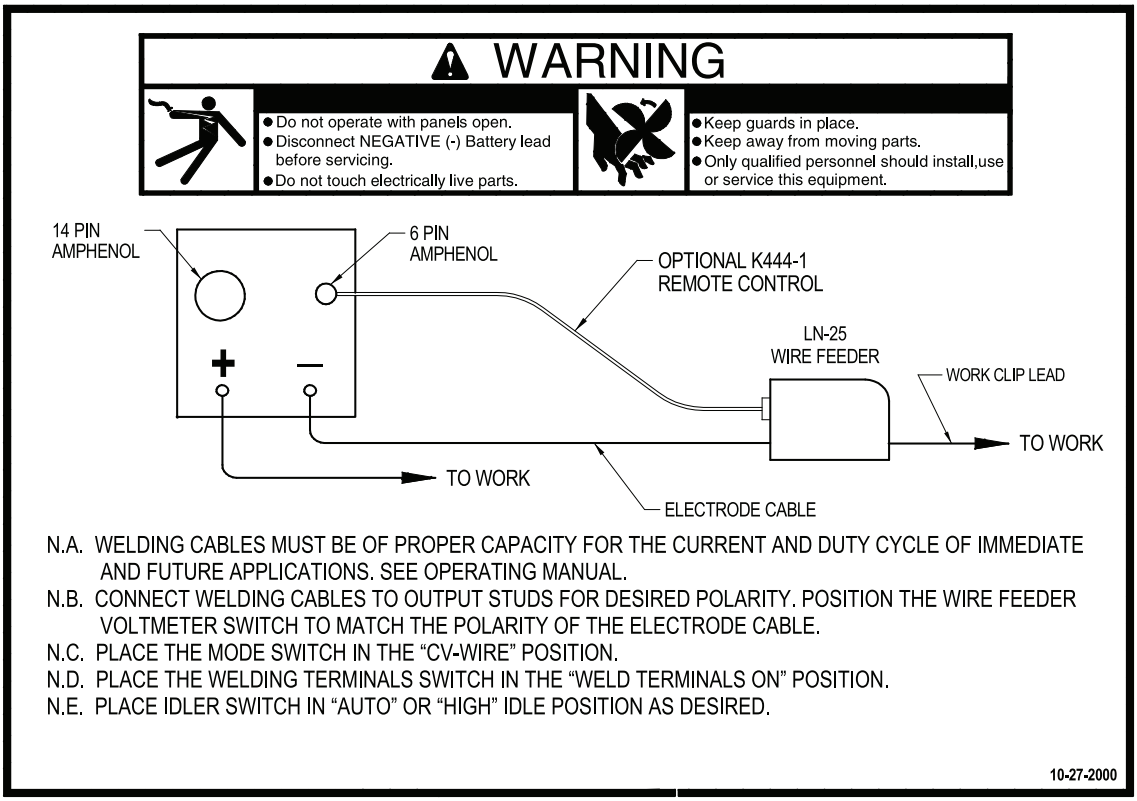
ENGINE WELDERS /LN-25 ACROSS THE ARC CONNECTION DIAGRAM WITH OPTIONAL K444-1 REMOTE CONTROL



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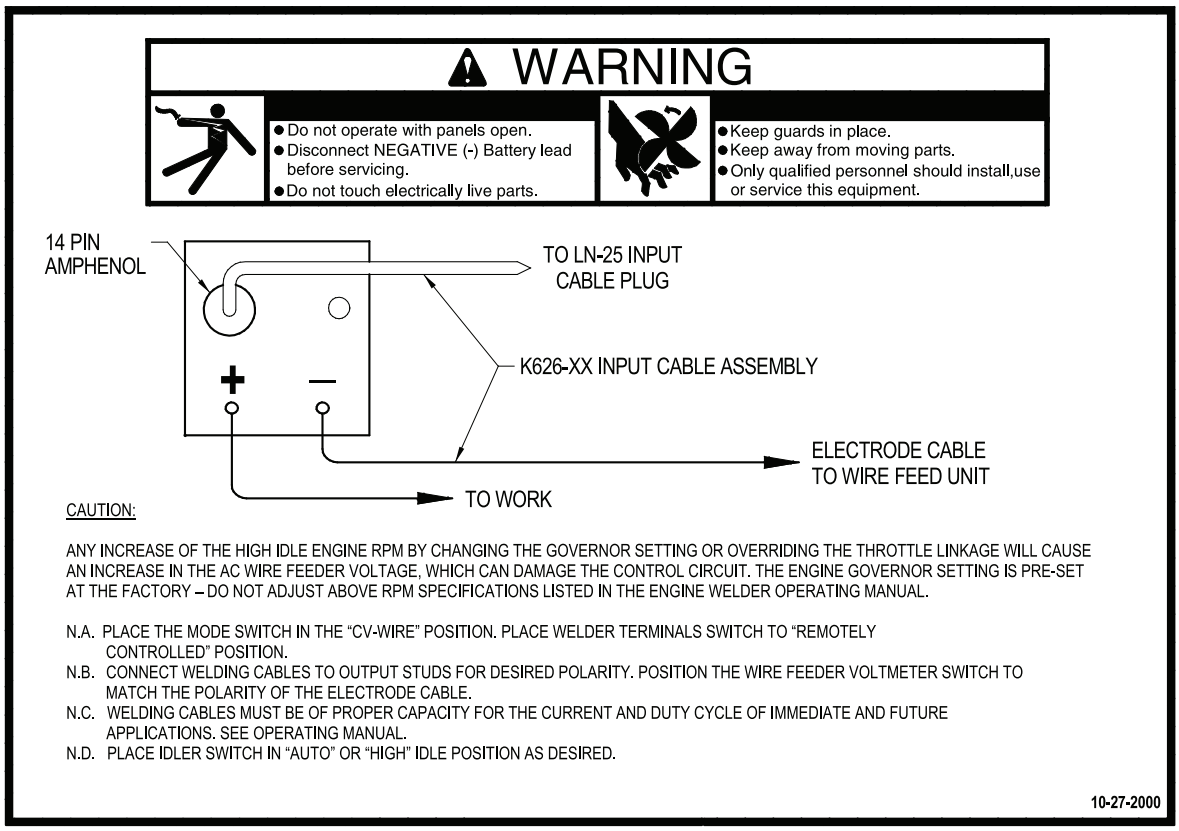
ENGINE WELDERS /LN-25 WITH K624-1 42 VOLT REMOTE OUTPUT CONTROL MODULE CONNECTION DIAGRAM



CAUTION:

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. PLACE THE MODE SWITCH IN THE "CV-WIRE" POSITION. PLACE WELDER TERMINALS SWITCH TO "REMOTELY CONTROLLED" POSITION.
N.B. CONNECT WELDING CABLES TO OUTPUT STUDS FOR DESIRED POLARITY. POSITION THE WIRE FEEDER VOLTMETER SWITCH TO MATCH THE POLARITY OF THE ELECTRODE CABLE.
N.C. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.D. PLACE IDLER SWITCH IN "AUTO" OR "HIGH" IDLE POSITION AS DESIRED.

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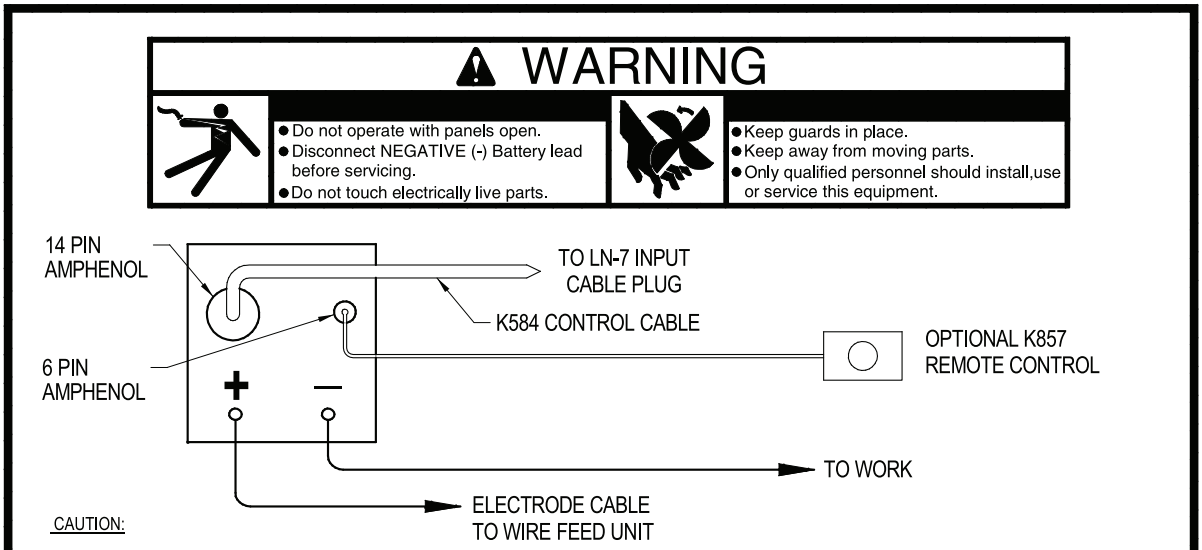
ENGINE WELDERS /LN-7 CONNECTION DIAGRAM



CAUTION:

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.B. CONNECT WELDING CABLES TO OUTPUT STUDS FOR DESIRED POLARITY. POSITION THE WIRE FEEDER VOLTMETER SWITCH TO MATCH THE POLARITY OF THE ELECTRODE CABLE.
N.C. PLACE THE MODE SWITCH IN THE "CV-WIRE" POSITION.
N.D. PLACE IDLER SWITCH IN "HIGH" POSITION.

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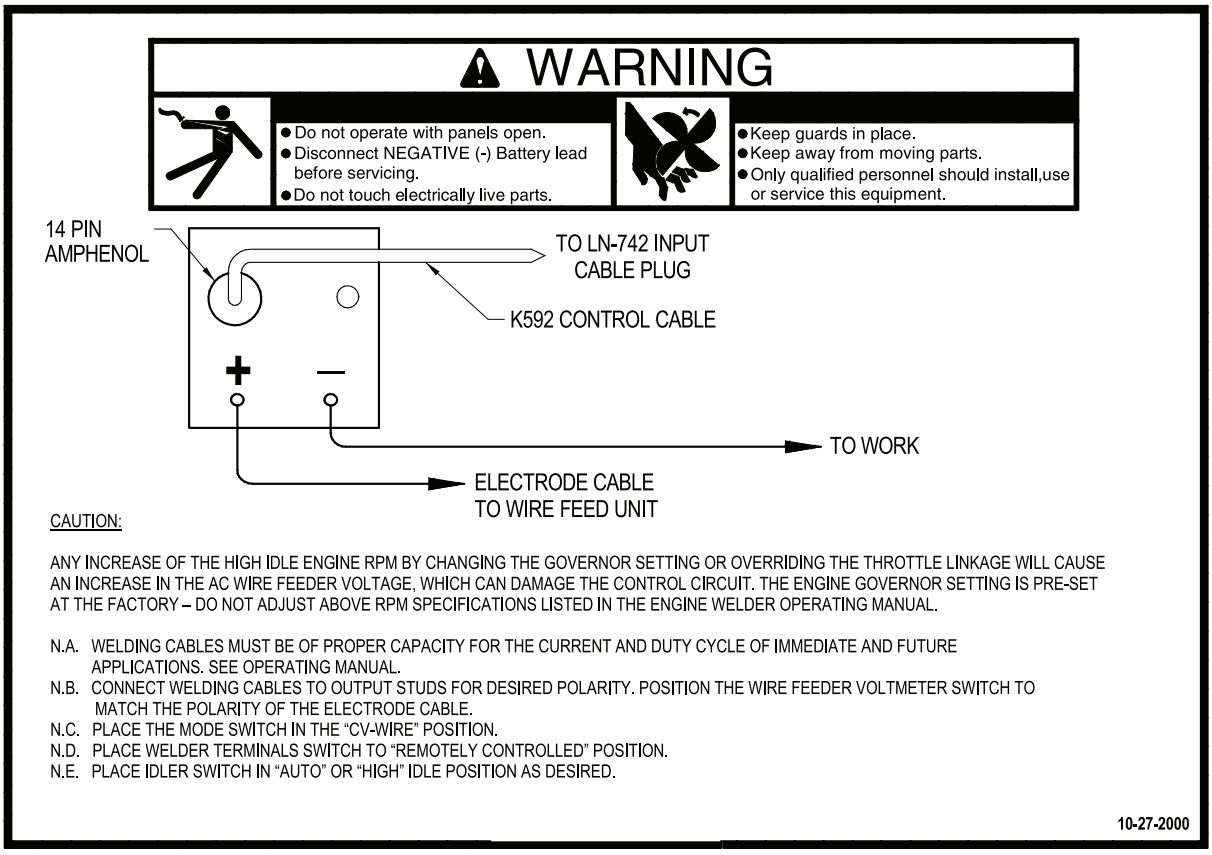
ENGINE WELDERS /LN-742 CONNECTION DIAGRAM



CAUTION:

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.B. CONNECT WELDING CABLES TO OUTPUT STUDS FOR DESIRED POLARITY. POSITION THE WIRE FEEDER VOLTMETER SWITCH TO MATCH THE POLARITY OF THE ELECTRODE CABLE.
N.C. PLACE THE MODE SWITCH IN THE "CV-WIRE" POSITION.
N.D. PLACE WELDER TERMINALS SWITCH TO "REMOTELY CONTROLLED" POSITION.
N.E. PLACE IDLER SWITCH IN "AUTO" OR "HIGH" IDLE POSITION AS DESIRED.

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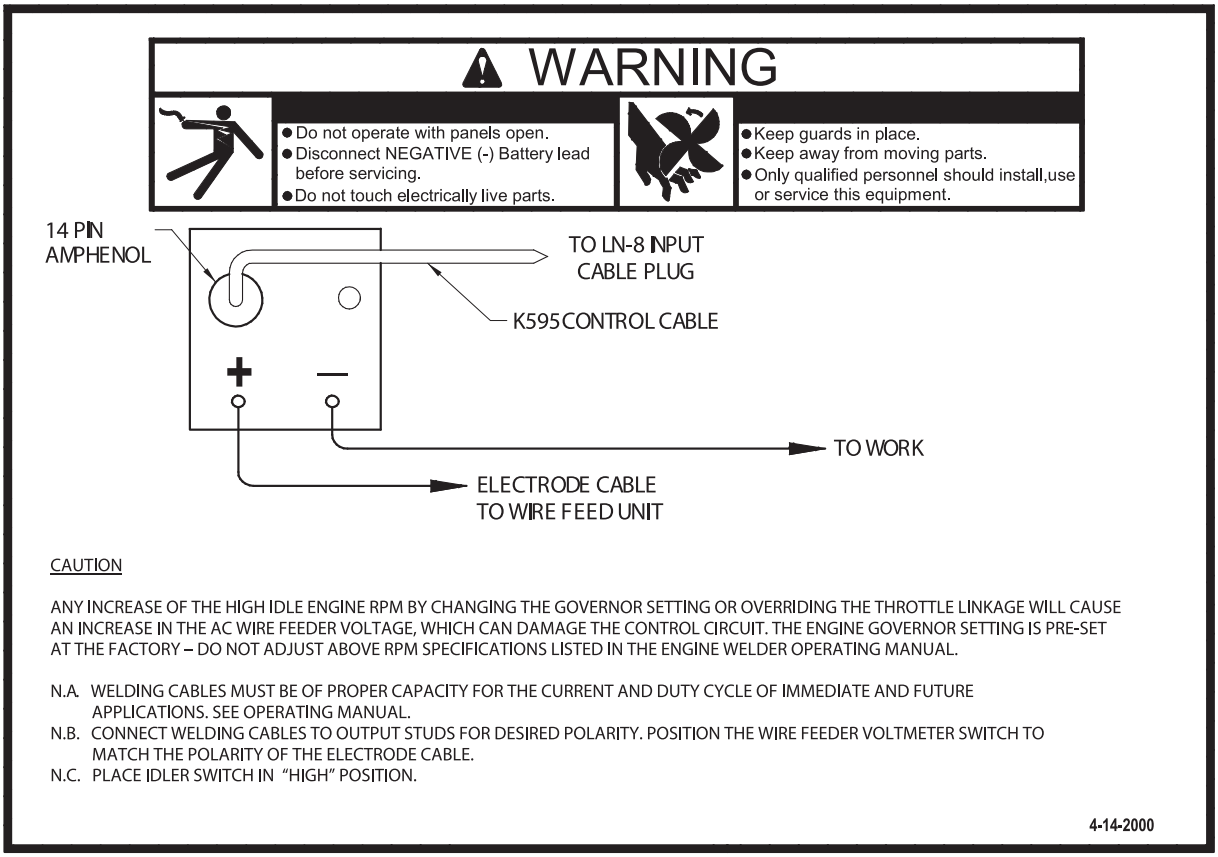
ENGINE WELDERS /LN-8 CONNECTION DIAGRAM



CAUTION

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.B. CONNECT WELDING CABLES TO OUTPUT STUDS FOR DESIRED POLARITY. POSITION THE WIRE FEEDER VOLTMETER SWITCH TO MATCH THE POLARITY OF THE ELECTRODE CABLE.
N.C. PLACE IDLER SWITCH IN "HIGH" POSITION.

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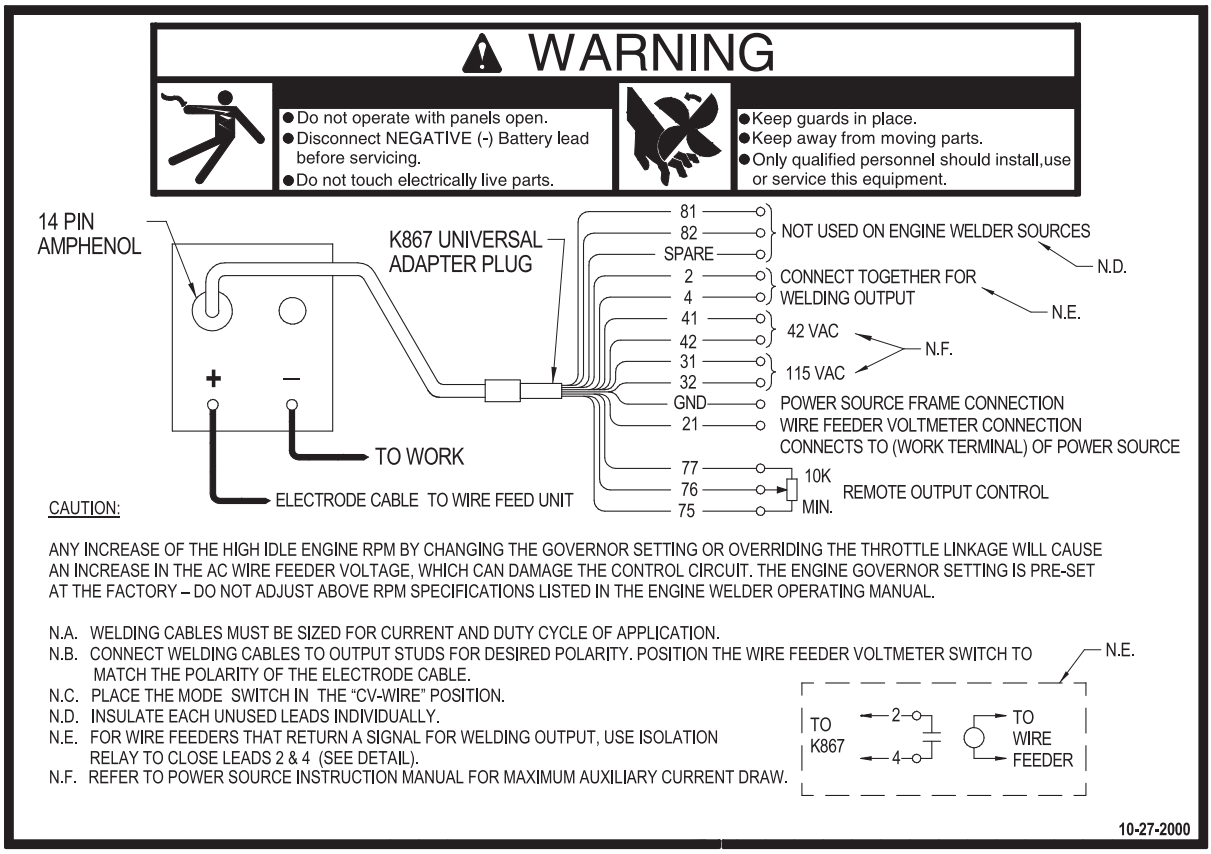
ENGINE WELDERS TO K867 CONTROL CABLE ADAPTER CONNECTION DIAGRAM



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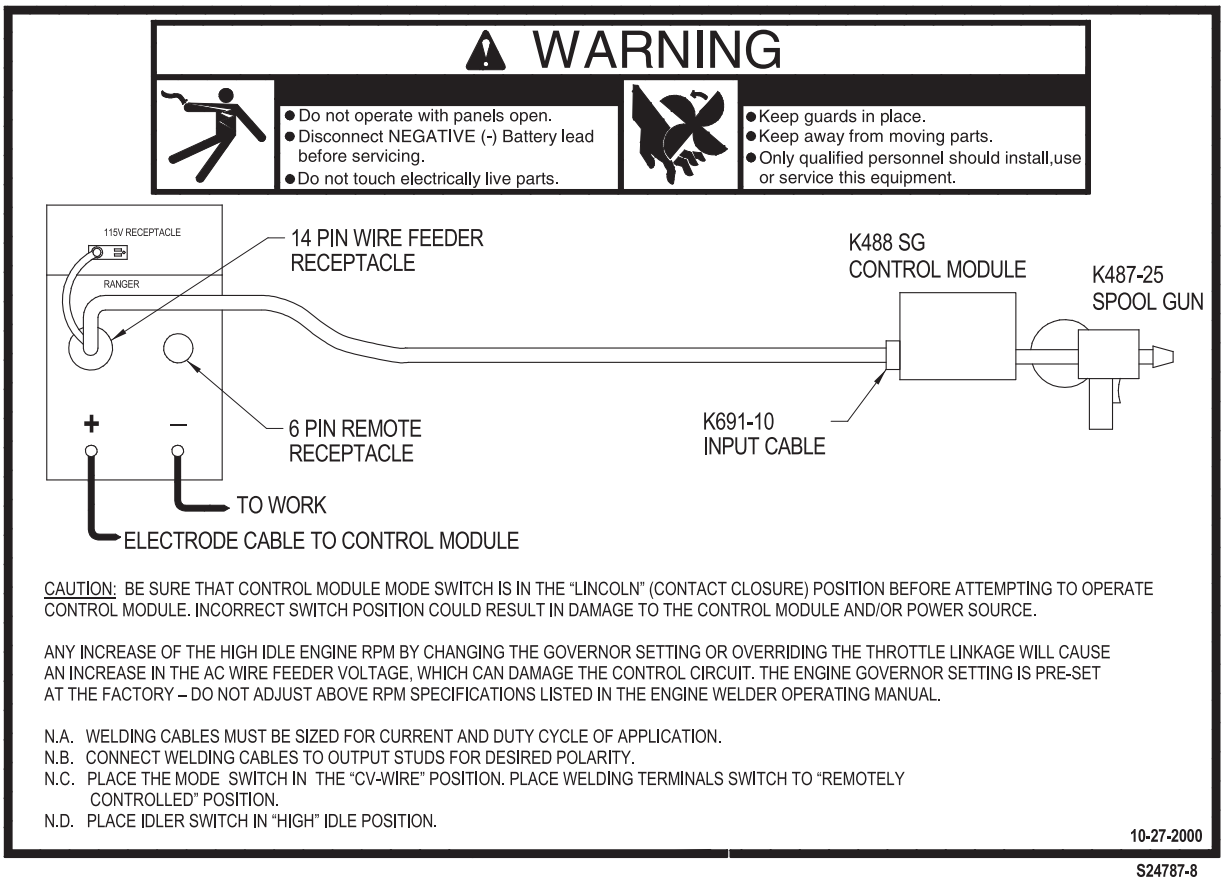
ENGINE WELDERS / K691-10 / K488 / K487 SPOOL GUN CONNECTION DIAGRAM



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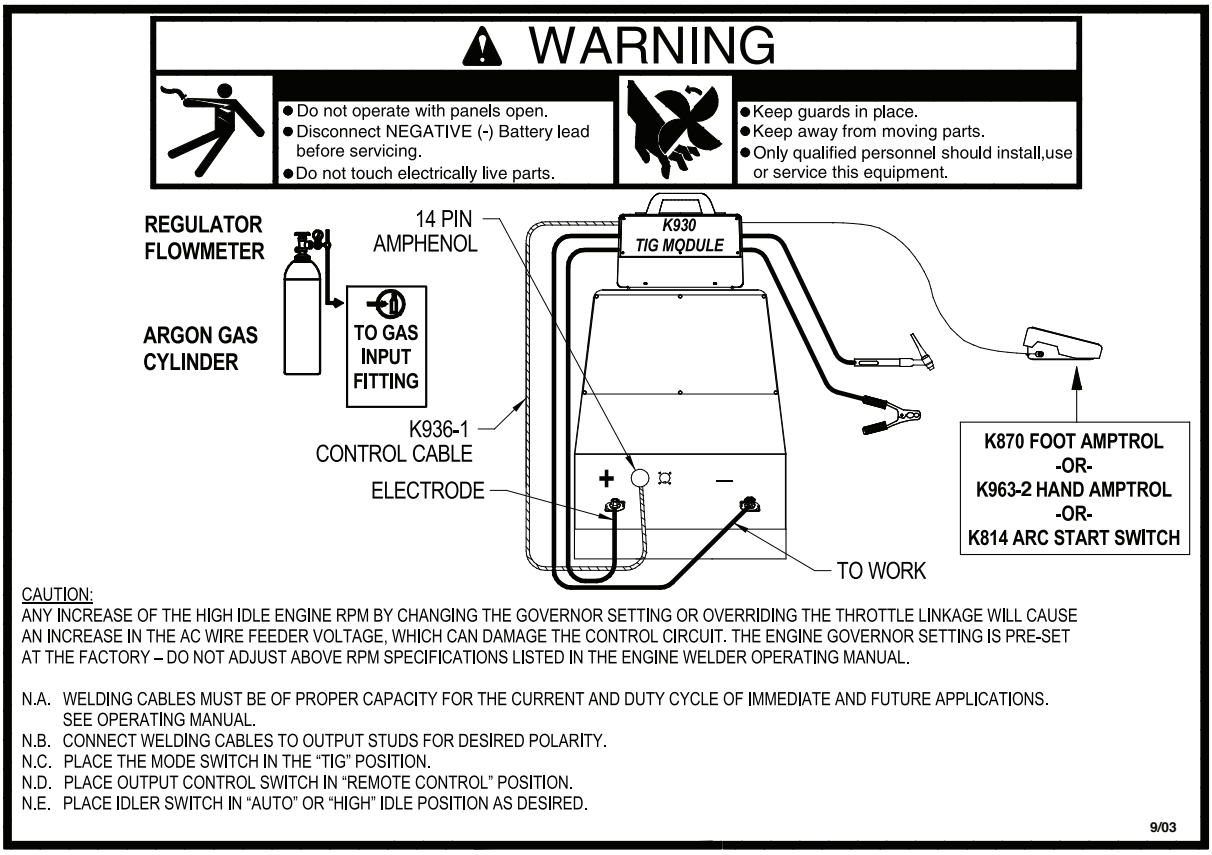
ENGINE WELDERS / K930 TIG MODULE / CONNECTION DIAGRAM



CAUTION:
ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.B. CONNECT WELDING CABLES TO OUTPUT STUDS FOR DESIRED POLARITY.
N.C. PLACE THE MODE SWITCH IN THE "TIG" POSITION.
N.D. PLACE OUTPUT CONTROL SWITCH IN "REMOTE CONTROL" POSITION.
N.E. PLACE IDLER SWITCH IN "AUTO" OR "HIGH" IDLE POSITION AS DESIRED.

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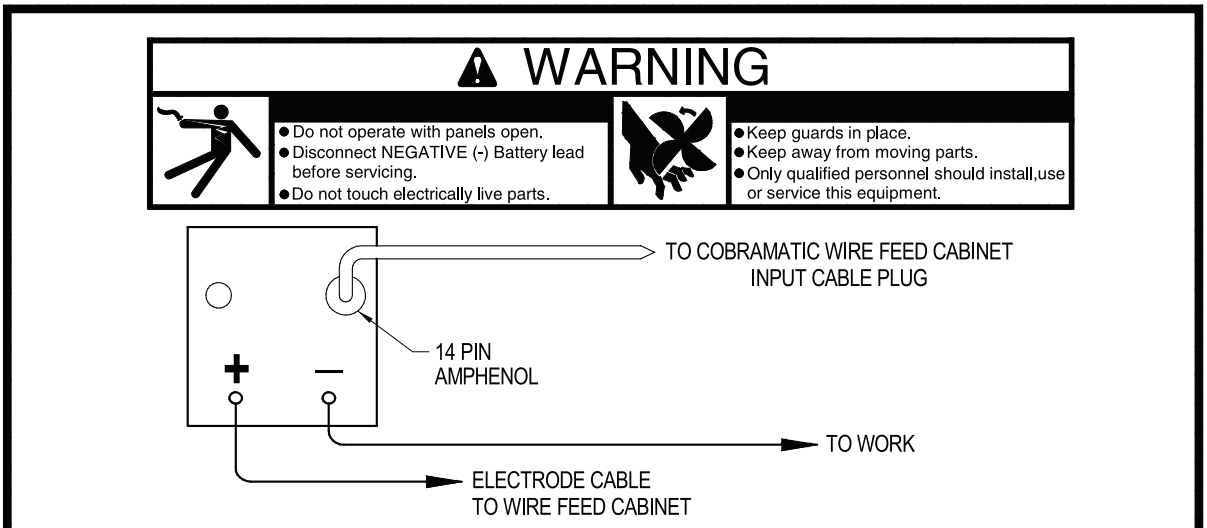
ENGINE WELDERS / K1587-1 COBRAMATIC CONNECTION DIAGRAM



CAUTION:

ANY INCREASE OF THE HIGH IDLE ENGINE RPM BY CHANGING THE GOVERNOR SETTING OR OVERRIDING THE THROTTLE LINKAGE WILL CAUSE AN INCREASE IN THE AC WIRE FEEDER VOLTAGE, WHICH CAN DAMAGE THE CONTROL CIRCUIT. THE ENGINE GOVERNOR SETTING IS PRE-SET AT THE FACTORY – DO NOT ADJUST ABOVE RPM SPECIFICATIONS LISTED IN THE ENGINE WELDER OPERATING MANUAL.

N.A. WELDING CABLES MUST BE OF PROPER CAPACITY FOR THE CURRENT AND DUTY CYCLE OF IMMEDIATE AND FUTURE APPLICATIONS. SEE OPERATING MANUAL.
N.B. SET THE WIRE FEEDER VOLTMETER TO THE "+" POSITION. THE POSA-START FEATURE WILL NOT OPERATE UNLESS THIS SWITCH IS SET TO MATCH THE POLARITY OF THE ELECTRODE CABLE.
N.C. POSITION THE MODE SWITCH TO "CV-WIRE".

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NOTES

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SAFETY PRECAUTIONS

⚠ WARNING

- **Have qualified personnel do all maintenance and troubleshooting work.**
- **Turn the engine off before working inside the machine or servicing the engine.**
- **Remove guards only when necessary to perform maintenance and replace them when the maintenance requiring their removal is complete. If guards are missing from the machine, obtain replacements from a Lincoln Distributor. (See Operating Manual Parts List.)**

Read the Safety Precautions in the front of this manual and in the Engine Owner's Manual before working on this machine.

Keep all equipment safety guards, covers, and devices in position and in good repair. Keep hands, hair, clothing, and tools away from the gears, fans, and all other moving parts when starting, operating, or repairing the equipment.

Routine Maintenance

At the end of each day's use, refill the fuel tank to minimize moisture condensation in the tank. Running out of fuel tends to draw dirt into the fuel system. Also, check the crankcase oil level and add oil if indicated.

ENGINE SERVICE

EVERY DAY OR EVERY 8 HOURS	FIRST SERVICE (20 / 50 HOURS)	EVERY 100 HOURS OR 3 MONTHS	EVERY 250 HOURS OR 6 MONTHS	EVERY 500 HOURS OR 12 MONTHS	EVERY 1000 HOURS	ENGINE SERVICE (NOTE 2)	
						MAINTENANCE ITEM	TYPE OR QUANTITY
I						Coolant Level	
			I			Concentration of Antifreeze	50/50 Water/Ethylene Glycol
					R	Coolant (NOTE 3)	9.5 qt., 9.0 L
I						Engine oil level (NOTE 1)	
	R			R		Engine oil (NOTE 1 & 3)	8.45qt., 8L (Including filter)
	R			R		Engine oil filter	Perkins #140517050
C						Drain water separator & fuel strainer	
				R		Water separator element	Lincoln # M20840-A
				R		Fuel filter canister	Perkins #130366120
			I			Tension of alternator drive belt	
			I			Alternator drive belt wear	
					R	Alternator drive belt	Perkins #080109107
C						Air filter (earlier check may be required)	
				R		Air filter element	Donaldson #P821575
					R	Renew the engine breather	
					I	Tighten cylinder head	
					I	Valve clearances	Intake .008", exhaust .008"
					I	Electrical systems	
					I	All nuts and bolts for tightness	
				I		Injector performance	Contact Perkins
I						Leaks or engine damage	
				I		Battery	

I = Inspect C = Clean R = Replace

Notes:

(1) Consult Engine Operators Manual for oil recommendations.

(2) Consult Engine Operators Manual for additional maintenance schedule information.

(3) Fill slowly! Ensure correct quantity is used.

Above operations to be carried out by trained personnel with reference to the workshop manual where necessary.

These preventive maintenance periods apply to average conditions of operation. If necessary, use shorter peroids.

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ENGINE OIL CHANGE

Drain the engine oil while the engine is warm to assure rapid and complete draining. It is recommended that each time the oil is changed the oil filter be changed as well.

- Be sure the unit is off. Disconnect the negative battery cable to ensure safety.
- Locate oil drain hose and valve in bottom of base and pull through the hole in the battery access panel on the welder.
- Open oil drain valve by lifting up spring loaded lever and rotate 90° counterclockwise. Pull to open and drain the oil into a suitable container for disposal.
- Close the drain valve by rotating lever 90° clockwise.
- Re-fill the crankcase to the upper limit mark on the dipstick with the recommended oil (see engine operation manual OR engine service items decal OR below). Replace and tighten the oil filler cap securely.
- Push oil drain hose and valve back into unit, re-connect negative battery cable, and close doors and engine top cover before restarting unit.Wash your hands with soap and water after handling used motor oil. Please dispose of used motor oil in a manner that is compatible with the environment. We suggest you take it in a sealed container to your local service station or recycling center for reclamation. DO NOT throw it in the trash; pour it on the ground or down a drain.

Use motor oil designed for diesel engines that meets requirements for API service classification CC/CD/CE/CF/CF-4/CG-4 or CH-4.

ACEA E1/E2/E3. Always check the API service label on the oil container to be sure it includes the letters indicated. (Note: An S-grade oil must not be used in a diesel engine or damage may result. It IS permissible to use an oil that meets S and C grade service classifications.)

SAE 10W30 is recommended for general, all temperature use, 5F to 104F (-15C to 40C).

See engine owner's manual for more specific information on oil viscosity recommendations.

OIL FILTER CHANGE

- Drain the oil.
- Remove the oil filter with an oil filter wrench and drain the oil into a suitable container. Discard the used filter. Note: Care should be taken during filter removal to not disrupt or damage in any way the fuel lines.
- Clean the filter mounting base and coat the gasket of the new filter with clean engine oil.
- Screw the new filter on by hand until the gasket contacts the mounting base. Using an oil filter wrench, tighten the filter an additional 1/2 to 7/8 of a turn.
- Refill the crankcase with the specified amount of the recommended engine oil. Reinstall the oil filler cap and tighten securely.
- Start the engine and check for oil filter leaks.
- Stop the engine and check the oil level. If necessary, add oil to the upper limit mark on the dipstick.

⚠ WARNING

- **Never use gasoline or low flash point solvents for cleaning the air cleaner element. A fire or explosion could result.**

⚠ CAUTION

- **Never run the engine without the air cleaner. Rapid engine wear will result from contaminant's, such as dust and dirt being drawn into the engine.**

AIR CLEANER

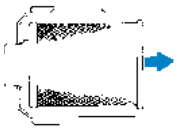
The diesel engine is equipped with a dry type air filter. Never apply oil to it. Service the air cleaner as follows:

Replace the element every 500 hours of operation. Under dusty conditions, replace sooner.

Service Instructions

Single- and Two-Stage Engine Air Cleaners

1 Remove the Filter



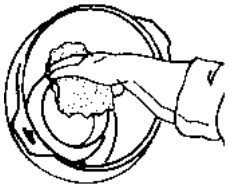
Rotate the filter while pulling straight out.

Unfasten or unlatch the service cover. Because the filter fits tightly over the outlet tube to create the critical seal, there will be some initial resistance, similar to breaking the seal on a jar. Gently move the end of the filter back and forth to break the seal then rotate while pulling straight out. Avoid knocking the filter against the housing.

If your air cleaner has a safety filter, replace it every third primary filter change. Remove the safety filter as you would the primary filter. Make sure you cover the air cleaner outlet tube to avoid any unfiltered contaminant dropping into the engine.

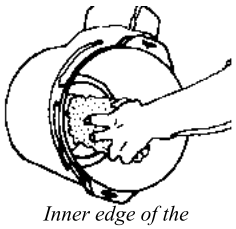
2 Clean Both Surfaces of the Outlet Tube and Check the Vacuator™ Valve

Use a clean cloth to wipe the filter sealing surface and the inside of the outlet tube. Contaminant on the sealing surface could hinder an effective seal and cause leakage. Make sure that all contaminant is removed before the new filter is inserted. Dirt accidently transferred to the inside of the outlet tube will reach the engine and cause wear. Engine manufacturers say that it takes only a few grams of dirt to "dust" an engine! Be careful not to damage the sealing area on the tube.



Outer edge of the outlet tube

Wipe both sides of the outlet tube clean.

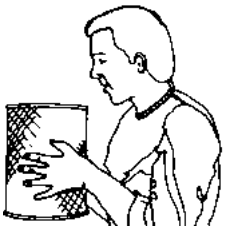


Inner edge of the outlet tube

If your air cleaner is equipped with a Vacuator Valve
Visually check and physically squeeze to make sure the valve is flexible and not inverted, damaged or plugged.

3 Inspect the Old Filter for Leak Clues

Visually inspect the old filter for any signs of leaks. A streak of dust on the clean side of the filter is a telltale sign. Remove any cause of leaks before installing new filter.



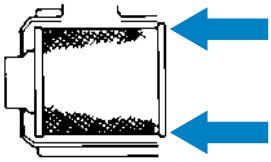
4 Inspect the New Filter for Damage

Inspect the new filter carefully, paying attention to the inside of the open end, which is the sealing area. NEVER install a damaged filter. A new Donaldson radial seal filter may have a dry lubricant on the seal to aid installation.

5 Insert the New Radial Seal Filter Properly

If you're servicing the safety filter, this should be seated into position before installing the primary filter.

Insert the new filter carefully. Seat the filter by hand, making certain it is completely into the air cleaner housing before securing the cover in place.



The critical sealing area will stretch slightly, adjust itself and distribute the sealing pressure evenly. To complete a tight seal, apply pressure by hand at the outer rim of the filter, not the flexible center. (Avoid pushing on the center of the urethane end cap.) No cover pressure is required to hold the seal. NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.

If the service cover hits the filter before it is fully in place, remove the cover and push the filter (by hand) further into the air cleaner and try again. The cover should go on with no extra force.

Once the filter is in place, secure the service cover.

Caution

NEVER use the service cover to push the filter into place! Using the cover to push the filter in could cause damage to the housing, cover fasteners and will void the warranty.

6 Check Connectors for Tight Fit

Make sure that all mounting bands, clamps, bolts, and connections in the entire air cleaner system are tight. Check for holes in piping and repair if needed. Any leaks in your intake piping will send dust directly to the engine!

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COOLING SYSTEM

⚠ WARNING

HOT COOLANT can burn skin.

- **Do not remove cap if radiator is hot.**

Check the coolant level by observing the level in the radiator and recovery bottle. Add 50/50 antifreeze / water solution if the level is close to or below the "LOW" mark. do not fill above the "FULL" mark. Remove radiator cap and add coolant to radiator. Fill up to the top of the tube in the radiator filler neck which includes a connecting hose coming from the thermostat housing.

To drain the coolant, open the valve at the bottom of the radiator. Open the radiator cap to allow complete drainage. (Tighten the valve and refill with a 50/50 antifreeze/water solution.) Use an automotive grade (low silicate) ethylene glycol antifreeze. The cooling system capacity is 8.0 quarts (7.6L.). Squeeze upper and lower radiator hoses while filling to bleed air from system coolant. Replace and tighten the radiator cap.

⚠ CAUTION

Always premix the antifreeze and clean tap water before adding to the radiator. It is very important that a precise 50/50 solution be used with this engine year round. This gives proper cooling during hot weather and freezing protection to -34° F (-37° C).

Cooling solution exceeding 50% ethylene glycol can result in engine overheating and damage to the engine. Coolant solution must be premixed before adding to radiator.

Periodically remove the dirt from the radiator fins. Periodically check the fan belt and radiator hoses. Replace if signs of deterioration are found.

TIGHTENING THE FAN BELT

If the fan belt is loose, the engine can overheat and the battery lose its charge. Check tightness by pressing on the belt midway between the pulleys. It should deflect about .25 in.(6.4 mm) under a load of 20 lbs.(9 Kg).

FUEL

At the end of each day's use, refill the fuel tank to minimize moisture condensation and dirt contamination in the fuel line. Do not overfill; leave room for the fuel to expand.

Use only fresh No. 2D diesel fuel, the use of No. 1D diesel fuel is recommended in place of No. 2D at temperatures below 23°F (-5°C). Do not use kerosene.

See the Engine Operator's Manual for instructions on replacing the fuel filter.

BLEEDING THE FUEL SYSTEM

You may need to bleed air from the fuel system if the fuel filter or fuel lines have been detached, the fuel tank has been ran empty or after periods of long storage. It is recommended that the fuel shutoff valve be closed during periods of non-use.

⚠ WARNING

To avoid personal injury, do not bleed a hot engine. This could cause fuel to spill onto a hot exhaust manifold, creating a danger of fire.

Bleed the fuel system as follows:

1. Fill the fuel tank with fuel.
2. Open the fuel shut off valve.
3. Loosen bleed fitting on the fuel injector manifold.
4. Operate hand priming lever until fuel comes out the bleed screw on the injector manifold. This could take 20-30 seconds of rapid operation of the priming lever. Tighten bleed fitting on injector manifold.
5. Follow normal STARTING procedures until engine starts.

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FUEL FILTER

1. Check the fuel filter and fuel pre-filter for water accumulation or sediment.
2. Replace the fuel filter if it is found with excessive water accumulation or sediment. Empty fuel pre-filter.

ENGINE ADJUSTMENT

OVERSPEED IS HAZARDOUS

The maximum allowable high idle speed for this machine is 1890 RPM, no load. Do NOT tamper with governor components or setting or make any other adjustments to increase the maximum speed. Severe personal injury and damage to the machine can result if operated at speeds above maximum.

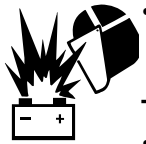
Adjustments to the engine are to be made only by a Lincoln Service Center or an authorized Field Service Shop.

BATTERY MAINTENANCE

To access the battery, remove the battery tray from the front of the machine with 3/8" nut driver or flat head screw driver. Pull the tray out of machine far enough to disconnect the negative and then positive battery cables. The tray can then be tilted and lifted to remove the entire tray and battery from the machine for easy service.

⚠ WARNING

GASES FROM BATTERY can explode.



- **Keep sparks, flame and cigarettes away from battery.**

To prevent EXPLOSION when:

- **INSTALLING A NEW BATTERY — disconnect negative cable from old battery first and connect to new battery last.**
- **CONNECTING A BATTERY CHARGER — remove battery from welder by disconnecting negative cable first, then positive cable and battery clamp. When reinstalling, connect negative cable last. Keep well ventilated.**
- **USING A BOOSTER — connect positive lead to battery first then connect negative lead to negative battery lead at engine foot.**

BATTERY ACID can burn eyes and skin.

- **Wear gloves and eye protection and be careful when working near battery.**
- **Follow instructions printed on battery.**

CLEANING THE BATTERY

Keep the battery clean by wiping it with a damp cloth when dirty. If the terminals appear corroded, disconnect the battery cables and wash the terminals with an ammonia solution or a solution of 1/4 pound (0.1113 kg) of baking soda and 1 quart (0.9461L) of water. Be sure the battery vent plugs (if equipped) are tight so that none of the solution enters the cells.

After cleaning, flush the outside of the battery, the battery compartment, and surrounding areas with clear water. Coat the battery terminals lightly with petroleum jelly or a non-conductive grease to retard corrosion.

Keep the battery clean and dry. Moisture accumulation on the battery can lead to more rapid discharge and early battery failure.

CHECKING THE ELECTROLYTE LEVEL

If battery cells are low, fill them to the neck of the filler hole with distilled water and recharge. If one cell is low, check for leaks.

CHARGING THE BATTERY

When you charge, jump, replace, or otherwise connect battery cables to the battery, be sure the polarity is correct. Improper polarity can damage the charging circuit. The VANTAGE® 400 positive (+) battery terminal has a red terminal cover.

If you need to charge the battery with an external charger, disconnect the negative cable first, then the positive cable before you attach the charger leads. After the battery is charged, reconnect the positive battery cable first and the negative cable last. Failure to do so can result in damage to the internal charger components.

Follow the instructions of the battery charger manufacturer for proper charger settings and charging time.

SERVICING OPTIONAL SPARK ARRESTOR

Clean every 100 hours.

⚠ WARNING

- **MUFFLER MAY BE HOT**
- **ALLOW ENGINE TO COOL BEFORE INSTALLING THE SPARK ARRESTER!**
- **DO NOT OPERATE ENGINE WHILE INSTALLING THE SPARK ARRESTER!**

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WELDER / GENERATOR MAINTENANCE

STORAGE: Store in clean, dry protected areas.

CLEANING: Blow out the generator and controls periodically with low pressure air. Do this at least once a week in particularly dirty areas.

BRUSH REMOVAL AND REPLACEMENT: It's normal for the brushes and slip rings to wear and darken slightly. Inspect the brushes when a generator overhaul is necessary.

⚠ CAUTION

- **Do not attempt to polish slip rings while the engine is running.**

⚠ WARNING

- **Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions.**

GFCI RECEPTACLE TESTING AND RESETTING PROCEDURE

The GFCI receptacle should be properly tested at least once every month or whenever it is tripped. To properly test and reset the GFCI receptacle:

- If the receptacle has tripped, first carefully remove any load and check it for damage.
- If the equipment has been shut down, it must be restarted.
- The equipment needs to be operating at high idle speed and any necessary adjustments made on the control panel so that the equipment is providing at least 80 volts to the receptacle input terminals.
- The circuit breaker for this receptacle must not be tripped. Reset if necessary.
- Push the "Reset" button located on the GFCI receptacle. This will assure normal GFCI operation.
- Plug a night-light (with an "ON/OFF" switch) or other product (such as a lamp) into the GFCI receptacle and turn the product "ON".
- Push the "Test" button located on the GFCI receptacle. The night-light or other product should go "OFF".
- Push the "Reset" button, again. The light or other product should go "ON" again.

If the light or other product remains "ON" when the "Test" button is pushed, the GFCI is not working properly or has been incorrectly installed (miswired). If your GFCI is not working properly, contact a qualified, certified electrician who can assess the situation, rewire the GFCI if necessary or replace the device.

1. Case Front & Control Panel Assembly
2. Output Panel Assembly
3. Power Module Panel Assembly
4. Generator & Rotor Assembly
5. Base, Fuel Tank & Battery Assembly
6. Engine Assembly
7. Case Back & Radiator Assembly
8. Case Cover

MAJOR COMPONENT LOCATION

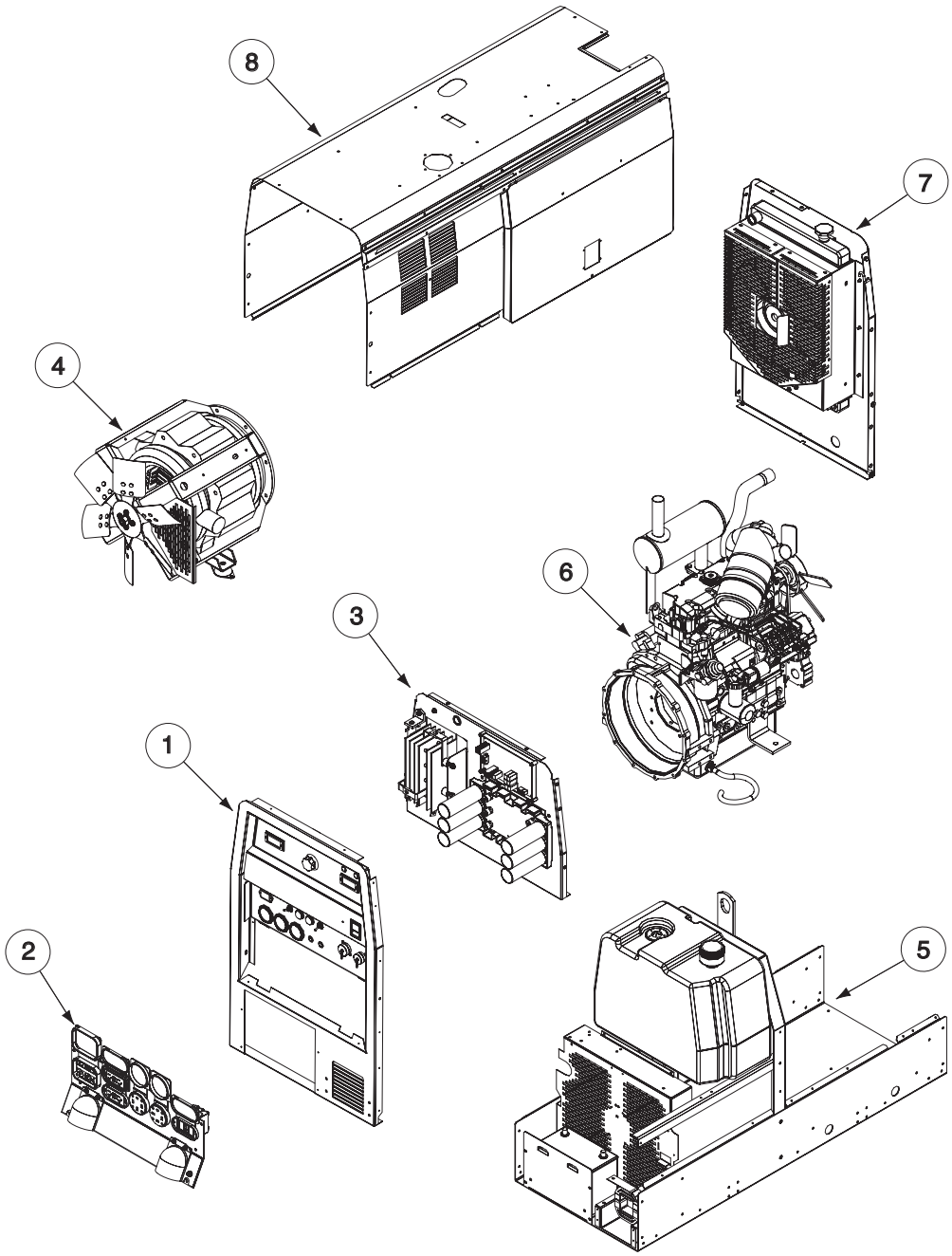

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FIGURE E.1 — VANTAGE® 400 BLOCK LOGIC DIAGRAM.

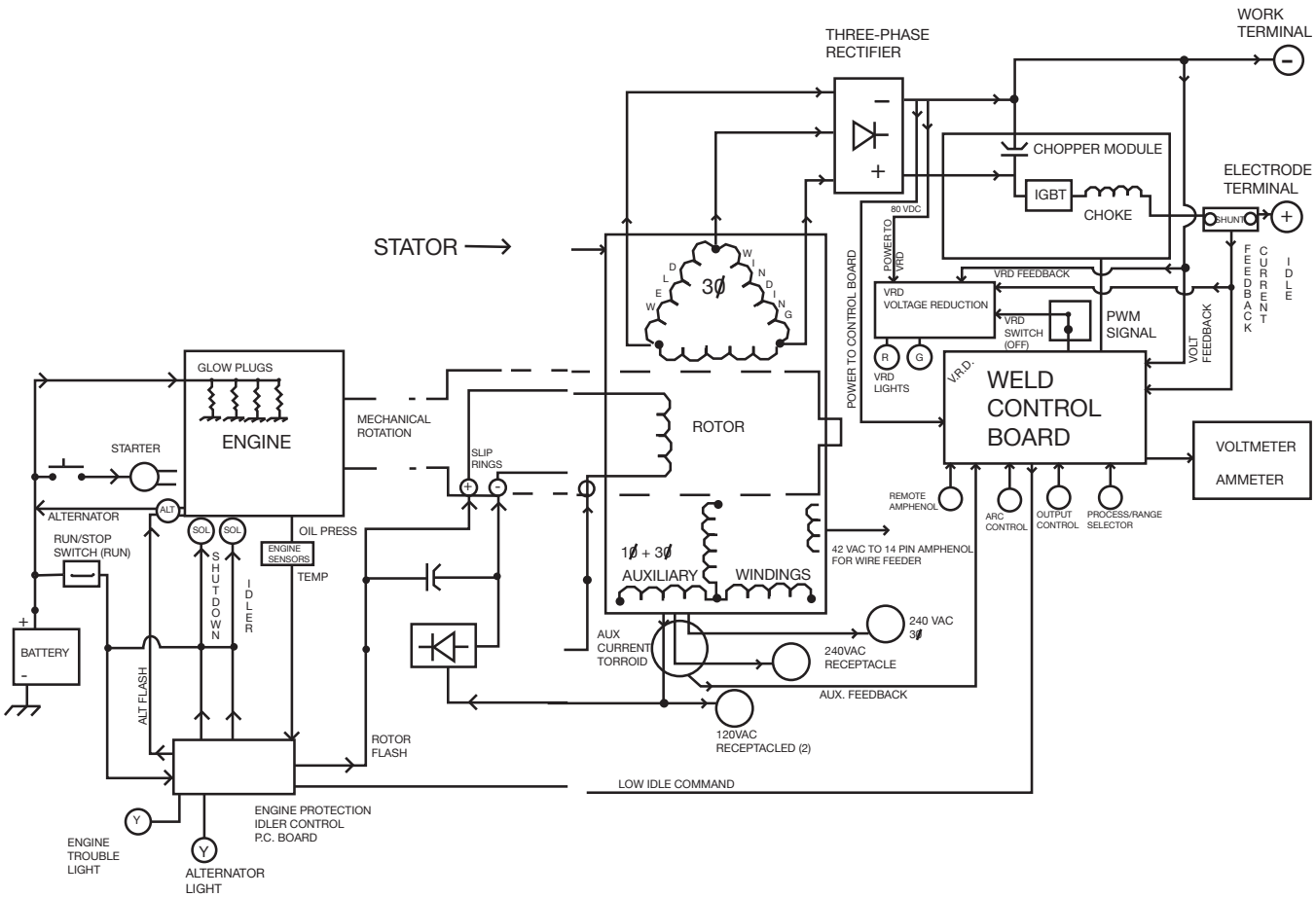
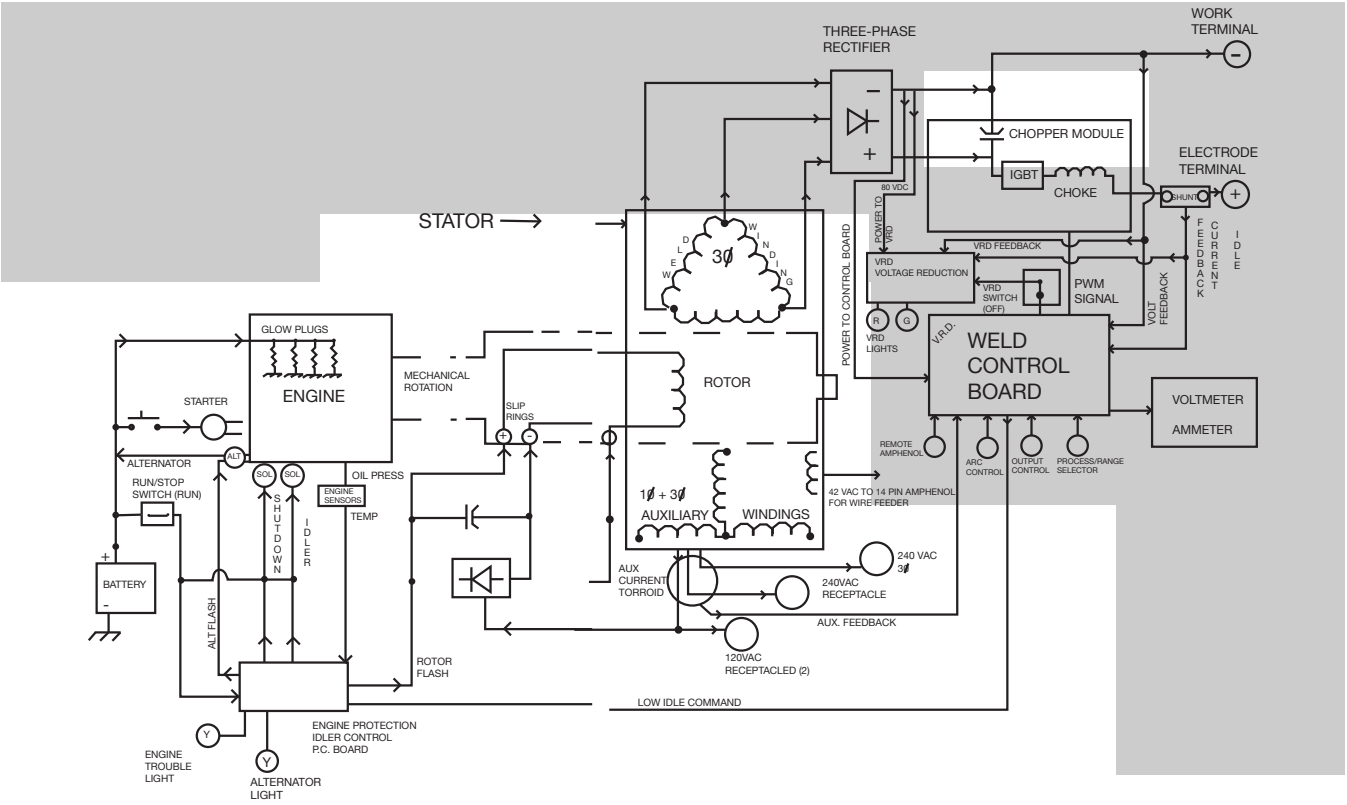


FIGURE E.2 — GENERAL DESCRIPTION, BATTERY, ENGINE, ROTOR, STATOR & ENGINE PROTECTION



GENERAL DESCRIPTION

The Vantage® 400 is a diesel engine-driven welding power source capable of producing 450 amps at 32VDC at a 100% duty cycle. The engine is coupled to a brush-type alternating current generator. This AC output is rectified and controlled by ***Chopper Technology*** to produce DC current for multi-purpose welding applications. The Vantage® 400 is also capable of producing 11,000 watts of AC auxiliary power at 100% duty cycle.

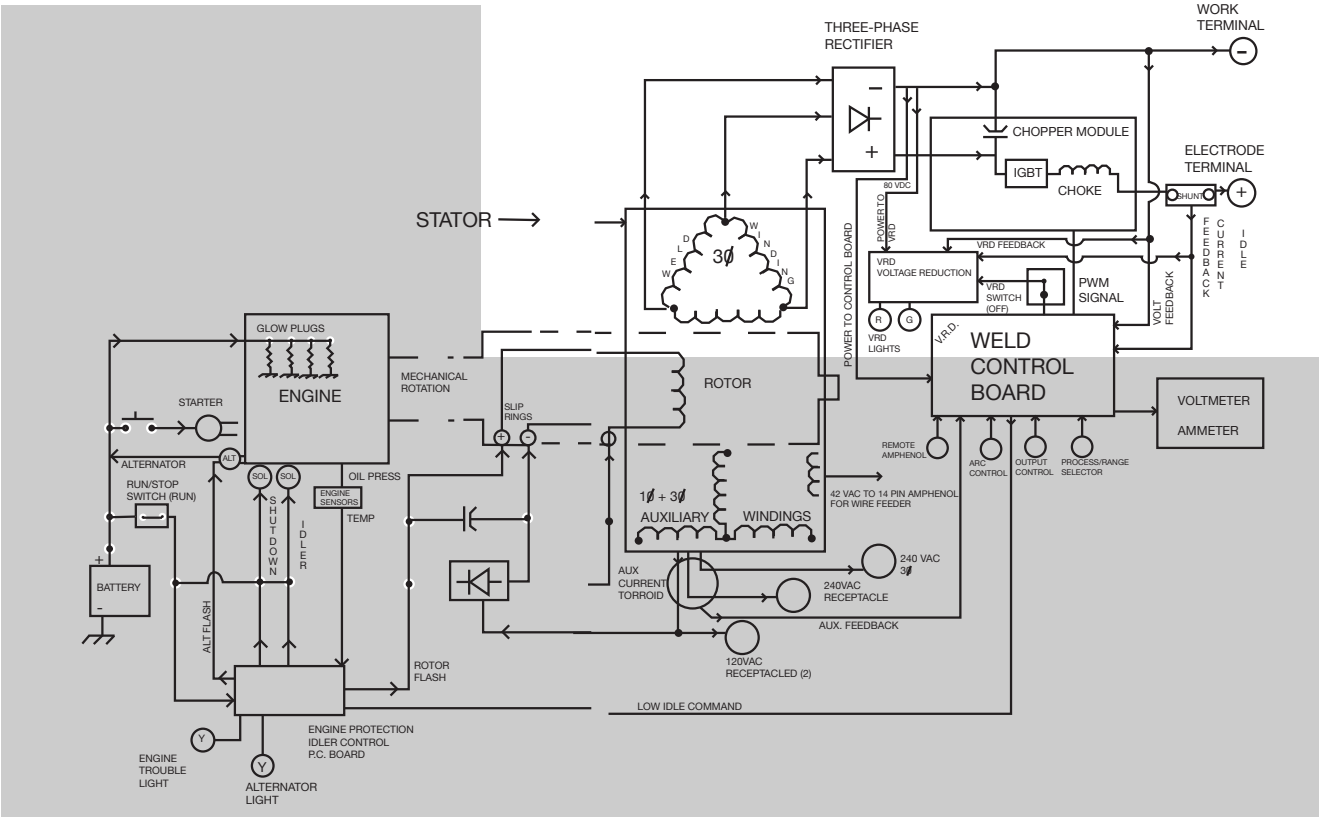
BATTERY, ENGINE, ROTOR, STATOR, PULL COIL BOARD AND PERIPHERAL BOARD – ENGINE PROTECTION

The 12VDC battery powers the engine starter motor and also supplies power to the Pull Coil PC board, Peripheral PC board and associated circuitry. When the engine, which is mechanically coupled to the rotor, is started and running, the 12 VDC battery voltage is fed through the pull coil PC board to the rotor field coil via a brush and slip ring configuration. This excitation or "flashing" voltage magnetizes the rotor lamination. This rotating magnet induces a voltage in the stationary windings of the main alternator stator. The stator houses a three-phase weld winding, a 120/240VAC single-phase auxiliary winding, and a 42VAC wire feeder power winding.

The engine alternator supplies charging current for the battery circuit. The Peripheral board monitors the engine sensors and will shut the engine off in the event of low oil pressure, engine over temperature, malfunction of the engine's alternator system or a low fuel condition. The idler solenoid is mechanically connected to the engine's throttle linkage. If no welding or auxiliary current is being drawn from the Vantage® 400, the Pull Coil board activates the idler solenoid, which then brings the engine to a low idle state. When output current is sensed, either weld or auxiliary, the Weld Control PC board deactivates the idler solenoid, and the engine returns to high RPM.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.3 — WELD WINDINGS, RECTIFIER, CHOPPER MODULES & FEEDBACK



WELD WINDINGS, RECTIFIER, POWER MODULES AND FEEDBACK

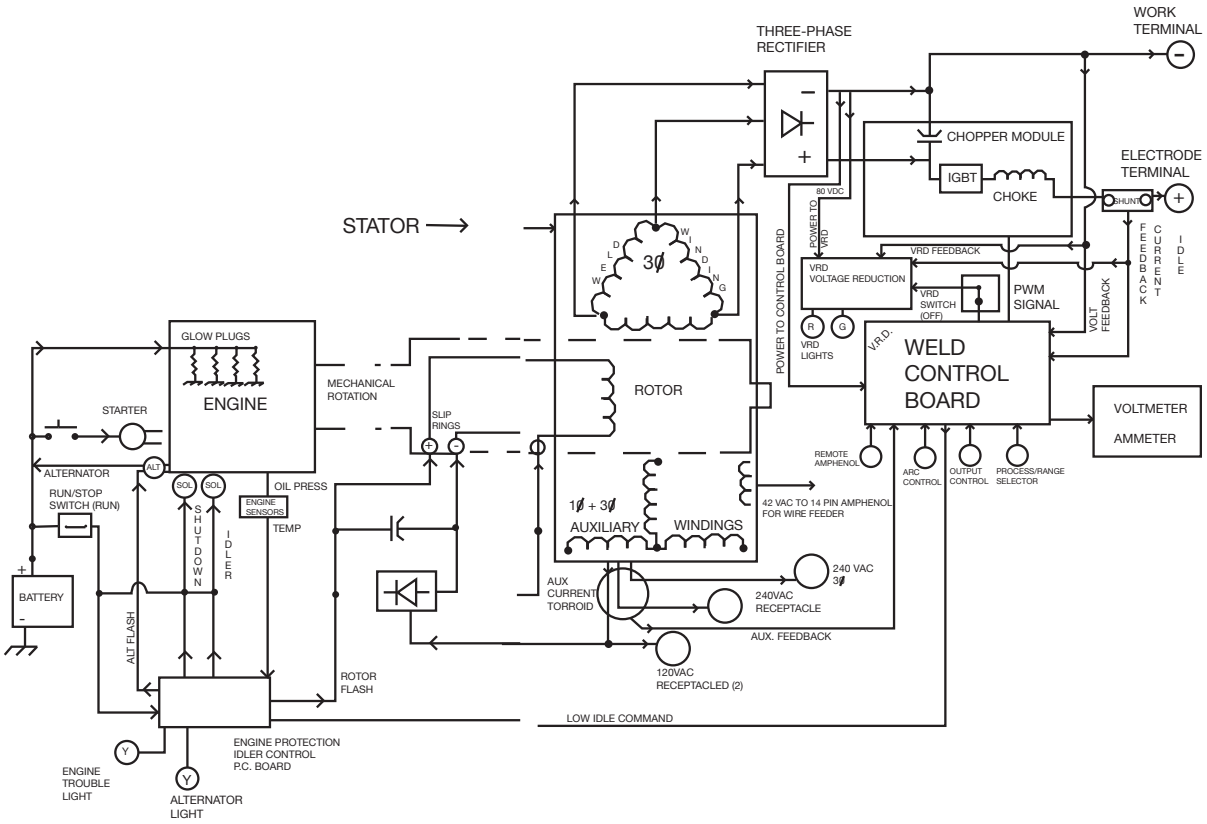
The three-phase stator weld windings are connected to a three-phase rectifier bridge. The resultant DC voltage is applied to four paralleled capacitors incorporated within each of the two power modules. There are two capacitors in each module. These capacitors function as filters and also as power supplies for the IGBTs. See ***IGBT Operation*** in this section. The IGBTs act as high-speed switches operating at 20KHZ. These devices are switched on and off by the Weld Control PC board through pulse width modulation circuitry. See ***Pulse Width Modulation*** in this section.

This "chopped" DC output is applied through choke coils and a shunt to the welding output terminals. The choke functions as a current filter, and it helps to balance the outputs of the two power modules. Freewheeling diodes are incorporated in the power modules to provide a current path for the stored energy in the choke when the IGBTs are turned off. See ***Chopper Technology*** in this section.

Output voltage and current feedback information is fed to the Weld Control PC board. This information is sensed from the output terminal circuits and the shunt.

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.4 — WELD CONTROL BOARD



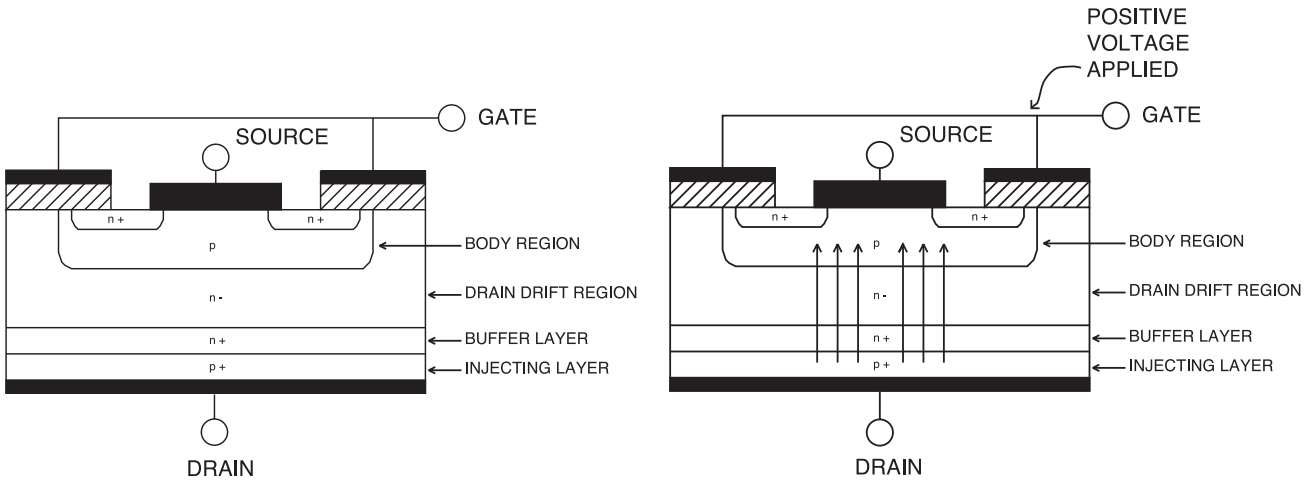
WELD CONTROL BOARD

The 80 VDC derived from the filter capacitors on the Power Modules, supplies various regulated DC voltages to operate the Weld Control PC board circuitry. It also supplies two regulated DC voltages to operate the IGBT driver circuitry on the two Power Modules.

The Weld Control PC board monitors the operator controls (arc control, output, and process/range selector). It compares these commands to the current and voltage feedback information it receives from the shunt and output terminal circuits. The circuitry on the Weld Control PC board determines how the output should be controlled to optimize welding results, and it sends the correct PWM signals to the IGBT driver circuits. The Weld Control PC board also commands the thermal light and the voltmeter and ammeter (some items may be optional).

NOTE: Unshaded areas of Block Logic Diagram are the subject of discussion

FIGURE E.5 – IGBT OPERATION



INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.

Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

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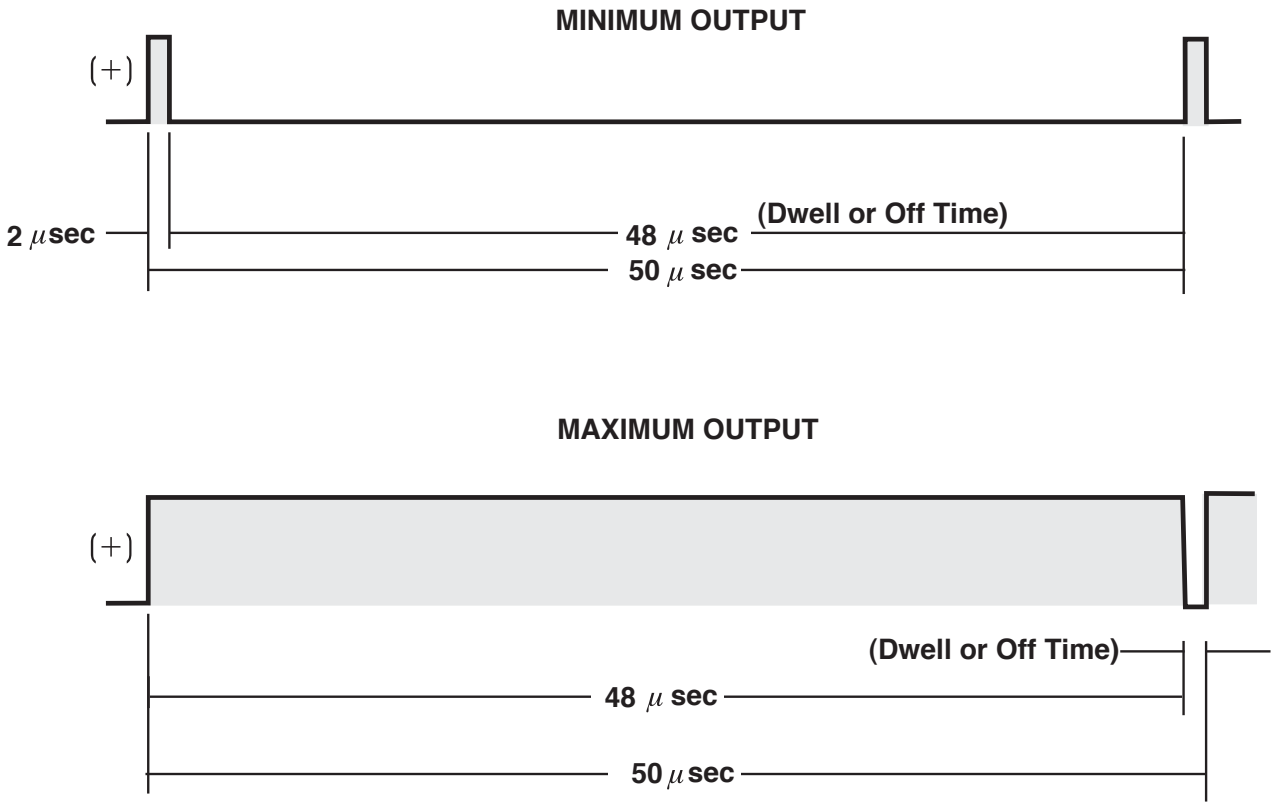
FIGURE E.6 – TYPICAL IGBT OUTPUTS



PULSE WIDTH MODULATION

The term PULSE WIDTH MODULATION is used to describe how much time is devoted to conduction in the cycle. Changing the pulse width is known as MODULATION. Pulse Width Modulation (PWM) is the varying of the pulse width over the allowed range of a cycle to affect the output of the machine.

MINIMUM OUTPUT

By controlling the duration of the gate signal, the IGBT is turned on and off for different durations during a cycle. The top drawing shows the minimum output signal possible over a 50-microsecond time period.

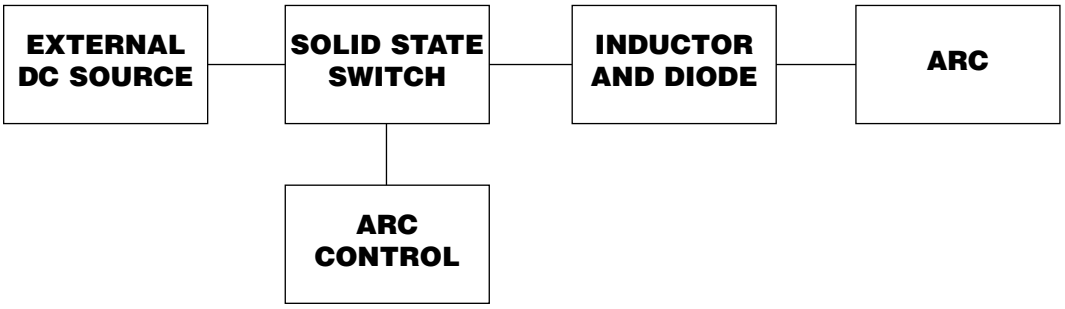
The positive portion of the signal represents one IGBT group conducting for 2 microsecond. The dwell time (off time) is 48 microseconds. Since only 2 microseconds of the 50-microsecond time period is devoted to conducting, the output power is minimized.

MAXIMUM OUTPUT

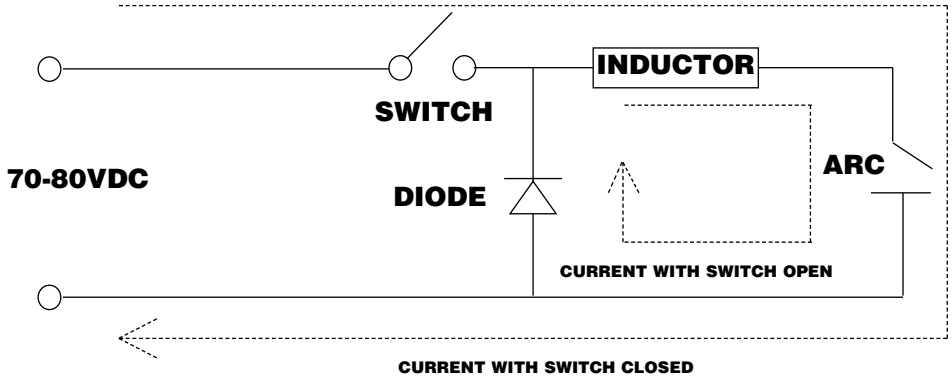
By holding the gate signals on for 48 microseconds and allowing only 2 microseconds of dwell time (off time) during the 50-microsecond cycle, the output is maximized. The darkened area under the top curve can be compared to the area under the bottom curve. The more darkened area under the curve, the more power is present.

CHOPPER TECHNOLOGY FUNDAMENTALS

The new era of welding machines such as the Vantage® 500, employ a technology whereby a DC source is turned on and off (chopped up) at high speed, then smoothed through an inductor to control an arc. Hence the name “Chopper.” The biggest advantage® of chopper technology is the high-speed control of the arc, similar to the inverter machines. A block diagram for this is as follows:



In this system, the engine drives a three-phase alternator, which generates power that is rectified and filtered to produce about 75VDC. The current is applied through a solid state switch to an inductor. By turning the switch on and off, current in the inductor and the arc can be controlled. The following diagram depicts the current flow in the system when the switch is open and closed.



When the switch is closed, current is applied through the inductor to the arc. When the switch opens, current stored in the inductor sustains flow in the arc and through the diode. The repetition rate of switch closure is 20Khz, which allows ultra-fast control of the arc. By varying the ratio of on time versus off time of the switch (Duty Cycle), the current applied to the arc is controlled. This is the basis for Chopper Technology: Controlling the switch in such a way as to produce superior welding.

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HOW TO USE TROUBLESHOOTING GUIDE

⚠ WARNING

Service and Repair should only be performed by Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM).
Look under the column labeled "PROBLEM (SYMPTOMS)". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into the following categories: output problems, function problems, wire feeding problems, and welding problems.

Step 2. PERFORM EXTERNAL TESTS.
The second column labeled "POSSIBLE AREAS OF MISADJUSTMENT(S)" lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. RECOMMENDED COURSE OF ACTION
The last column labeled "Recommended Course of Action" lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the specified test points, components, terminal strips, etc. can be found on the referenced electrical wiring diagrams and schematics. Refer to the Electrical Diagrams Section Table of Contents to locate the appropriate diagram.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

PC BOARD TROUBLESHOOTING PROCEDURES

⚠ WARNING

ELECTRIC SHOCK can kill.

- Have an electrician install and service this equipment. Turn the input power OFF at the fuse box before working on equipment. Do not touch electrically hot parts.

⚠ CAUTION

Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock. Read the warning inside the static resistant bag and perform the following procedures:

PC board can be damaged by static electricity.

ATTENTION Static-Sensitive Devices Handle only at Static-Safe Workstations

- Remove your body's static charge before opening the static-shielding bag. Wear an anti-static wrist strap. For safety, use a 1 Meg ohm resistive cord connected to a grounded part of the equipment frame.

- If you don't have a wrist strap, touch an un-painted, grounded, part of the equipment frame. Keep touching the frame to prevent static build-up. Be sure not to touch any electrically live parts at the same time.

- Tools which come in contact with the PC board must be either conductive, anti-static or static-disipative.

- Remove the PC board from the static-shielding bag and place it directly into the equipment. Don't set the PC board on or near paper, plastic or cloth which could have a static charge. If the PC board can't be installed immediately, put it back in the static-shielding bag.

- If the PC board uses protective shorting jumpers, don't remove them until installation is complete.

- If you return a PC board to The Lincoln Electric Company for credit, it must be in the static-shielding bag. This will prevent further damage and allow proper failure analysis.

4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: It is desirable to have a spare (known good) PC board available for PC board troubleshooting.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   a. If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   b. If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, "INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM," will help avoid denial of legitimate PC board warranty claims.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
Major mechanical or electrical damage is evident.	1. Contact your local Lincoln Authorized Field Service Facility.	1. Contact the Lincoln Electric Service Department at 1-888-935-3877.
No welding output or auxiliary power. The engine operates normally.	Check for loose or faulty connections in the auxiliary circuit to the output receptacles, and/or the weld circuit to the output terminals. ***SEE WIRING DIAGRAM.*** Check the brushes for wear ad proper contact to the rotor slip rings.	Check the brushes for wear and proper contact to the rotor slip rings Perform the ***Brush and Slip Ring Service Procedure.*** Check for flashing voltage at slip rings (3-5 Volts DC@.5 amp until generator builds up, then 160 Volts) See ***FLASHING VOLTAGE TEST.*** Check Field rectifier and capacitor. Perform the ***Rotor Voltage Test.*** Perform the ***Stator Voltage Test.***

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No welding output in any mode. The auxiliary output is normal. The engine operates normally.	Place the Welding Terminals switch in the "WELD TERMINALS ON" If the problem is solved and there is a control cab.e, wire feeder, amptrol, or arc start switch connected, the fault may lie in the above attached accessories. If the correct OCV is present at the weld output terminals, check the welding cables, connectors, work clamp, electrode holder, etc. For loose or faulty connections.	Check for damaged conductors or faulty connections on the heavy current carrying leads that connect the output studs to the Chopper module and to the Output Rectifier. Also check the shunt and the choke assemblies for damage and faulty connections. Check the Welding Terminals Switch and the associated leads. ***See Wiring Diagram.*** Check gate leads #23 nd #25 and Weld Control Board power leads #13 and #14 for loose or faulty connections. ***See Wiring Diagram.*** Perform the ***Chopper Module Function Test.*** Perform the ***STATOR VOLTAGE TEST.*** Perform the ***OUTPUT RECTIFIER TEST.*** The WELD CONTROL board may be faulty.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
No output in PIPE MODE. Outputs normal in other modes.	Make sure VRD ON/OFF toggle switch is in the off position. Faulty CONTROL PC BOARD. Faulty VRD display board.	Check the connections at the VRD ON/OFF switch. Check the VRD on off switch for proper function/continuity. See VRD functional description
VRD lights don't light up.	Ensure VRD ON/OFF switch is in the "ON" position. VRD light may be burned out, replace both VRD lights. Faulty VRD display P.C. Board.	Check connections at the VRD ON/OFF switch. Check the VRD on off switch for proper? See VRD functional description.
No auxiliary power at one or more receptacles or at the 14 pin Amphenol. Weld output is normal and the engine operates normally.	Check for loose or faulty connections at the output receptacles or 14 pin amphenol. Check for tripped circuit breaker and/or tripped GFCI receptacles.	Perform the ***Stator Voltage Test.*** Check the wiring between the auxiliary receptacle and the main stator.
The machine has low welding output and low auxiliary output.	The engine RPM may be low. The brushes may be sticking, poorly seated or slip rings dirty.	Then engine high idle speed may be low. ***Perform the Engine Throttle Test (Electronic Idler).*** Full load speed should be about 3500 RPM. Inspect and if necessary service the brushed and slip rings per the ***Brush and Slip Ring Service.*** Perform the ***Rotor Voltage Test.*** Perform the ***Stator Voltage Test.***

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The machine will weld but the welding arc is “COLD”. The engine runs normally and the auxiliary power is normal.	Make sure the machine is properly set for the electrode and process is being used. Check electrode size, mode switch setting, and amps or voltage setting. If gas is used make sure of correct type and gas flow. Make sure the process does not demand more power than the machine can produce. If the current is correct try increasing the “ARC CONTROL” setting. Check for loose or faulty connections at the weld output terminals and welding cable connections. Check for good connections between the work cable and the work piece. The work cable should be attached to clean metal, as close to the weld area as possible. The work clamp must be in good condition with good spring tension. The weld cables may be too long, or too small diameter causing excessive voltage drop. The weld cables may be coiled, or wrapped around metal racks or reels. This can cause excessive inductance in the weld circuit. Try welding with a short set of adequately sized weld cables.	The engine RPM may be too low. Perform the ***Engine Throttle Adjustment Test.*** Connect the machine to a resistive load bank. Connect an accurate ammeter and volt meter to the output of the machine. Connect a tachometer, Hz meter or another method to measure engine RPM. Place the mode switch in “CC-STICK, turn the output control to maximum idle switch to “HIGH” terminal switch to “WELD TERMINALS ON”. Nothing else attached or plugged into machine (No aux., no control cables). Start the machine allow the engine to reach normal operating temperature. Apply a load with the load bank. Load to 300 Amps, 32 Volts, 100% Duty Cycle. The engine should maintain 3350 RPM. If the engine cannot maintain the RPM make sure there is a supply of clean fresh fuel. Check the fuel filter and the air filter. Replace any filter that is dirty; or damaged. If this doesn’t help have the engine serviced. Compare the volt and amp readings displayed on the machine with that of the load bank. If these are significantly different, perform the ***WELD CONTROL FEEDBACK TEST.***

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
FUNCTION PROBLEMS		
The machine will weld but the welding arc is "COLD". The engine runs normally and the auxiliary power is normal. (continued)		If the maximum weld output cannot be obtained even though the front panel displays are reading accurately, check for damaged conductors and lose or damaged connections the large current carrying conductor connect the stator, output rectifier, chopper modules, choke, shunt, and output terminals. ***See the Wiring Diagram.*** If all these connections are good perform the ***ROTOR VOLTAGE TEST***, the ***STATOR VOLTAGE TEST,*** the ***OUTPUT RECTIFIER TEST***, and the ***CHOPPER MODULE RESISTANCE TEST.*** Perform the ***CONTROL POTENTIOMETER AND MODE RESISTANCE TEST.*** Perform the ***REMOTE RECEPTACLE RESISTANCE TEST.*** Replace the Control P.C. Board.
The machine welds but it will not maintain a steady output.	This condition may be normal in the Downhill Pipe Mode. The downhill pipe mode allows the arc current to increase and decrease slightly as the arc length changes. Check that the electrode is of good quality, dry and free from contamination. Try using some Lincoln Electrode, and setting the machine per Lincoln recommendation. If shielding gas is used, check that the gas and gas flow are correct. Check for damaged, pinched or leaking gas lines. Check for proper work, and electrode leads and connections (size, length, coils, or bad connections). The machine may not be maintaining the correct RPM.	Perform the THROTTLE ADJUSTMENT TEST. If the engine will not maintain the correct load RPM, the engine may be servicing fuel, air, and fuel filters should be checked. Check internal cables and leads that connect the weld winding of the stator, chopper module and the shunt, choke and output terminals. ***See the wiring diagram.*** Look for damaged conductors or faulty connections.

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The machine welds but it will not maintain a steady output. (continued)		There may be poor connections in the control wiring at the weld control P.C. Board, or the chopper board. Pull each plug from the weld P.C. board and thoroughly inspect the terminals in both the plugs and the P.C. Board receptacles. Make sure the connections are clean and the pins are properly seated in the plastic plug housing. Check for loose or damaged pins and faulty crimps. Check for damaged wiring and poor connections in the 13, 14, and the 23, and 25 leads, between the chopper module and weld control P.C. Board. The output control or the arc control potentiometer may be defective or grounded. The mode switch may also be faulty. Perform the ***POTENTIOMETER AND MODE SWITCH RESISTANCE TEST.*** The Amphenol receptacles may be contaminated or defective. Perform the ***REMOTE RECEPTACLE RESISTANCE TEST.*** Replace the weld control P.C. Board.

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The weld output can not be adjusted with the front panel output control knob in one or mode weld modes. The weld output terminals have normal OCV (open circuit voltage). The AC auxiliary power is normal and the engine operated normally.	Remote control devices completely disables the front output in all modes except touch start TIG mode. Make sure there is nothing plugged into the Amphenol receptacles. Check for dirt or moisture contamination in either the 6 pin or the 14 pin amphenol.	Perform the ***REMOTE RECEPTACLE RESISTANCE TEST.*** The output control potentiometer may be defective. Perform the ***CONTROL POTENTIOMETER AND MODE SWITCH RESISTANCE TEST.*** The WELD CONTROL BOARD may be faulty. See the Start-Up and OCV diagnostic chart.
The machine front panel output control is still active when the remote control unit is connected to one of the Front Panel Amphenols.	This condition is normal in the "TOUCH START TIG MODE". See the operators manual. The remote control unit may be defective. Check the Amphenol receptacles. Look for damage or corroded contact pins in the receptacle and in the plug of the remote control unit.	Check plug #P1 on the control P.C. Board. Plug should be properly seated and the pins in both the plug and the P.C. Board jack must be clean and fit tightly together. There may be a poor connection between the weld control P.C. Board and the amphenol receptacles. Check for continuity between the following terminals. See Wiring Diagram and Control Inner-Connection Diagram. P1-10 to 6 pin amphenol pin "C" and to pin 14 amphenol pin "G". P-1-11 to 6 pin amphenol pin "A" and to 14 pin amphenol pin "E". P-1-14 to 6 pin amphenol pin "B" and to 14 pin amphenol pin "F". The weld control P.C. Board may be defective.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
ENGINE PROBLEMS		
The machine seems to be locked into the "CC-stick" mode of operation.	Check the position of the WELD MODE selector switch. The switch should positively snap into each mode position and should not feel gritty or get stuck between positions.	Check that plug P-7 is fully seated into the weld control P.C. board socket. See Control Inner-Connection diagram. Check for corroded, dirty, or damaged Molex terminals in plug P-7, also check for similar problems in socket J-7 on the weld control P.C. board. Check the wiring between the control P.C. Board and the mode switch. Look for poor crimp and solder connections as well as damaged wiring or insulation. See wiring diagram. Perform the ***CONTROL POTENTIOMETER AND MODE SWITCH RESISTANCE TEST.*** The Weld control P.C. Board may be faulty.
The arc quality is poor with excessive spatter. The arc heat can be controlled and maintained normally, the auxiliary output is normal and the engine operates normally.	The ARC CONTROL may be set too high. The output control may be set too high for the electrode being used. Check that the electrode is of good quality, dry and free from contamination. Try using some Lincoln Electrode, and setting the machine per Lincoln's recommendation. If shielding gas is used, check that the gas and gas flow are correct. Check for damaged, pinched, or leaking gas lines. Check for proper work, and electrode leads and connections (size, length, coils, or bad connections).	Check that the weld circuit isn't grounded. With the engine off, check the resistance between chassis ground and the weld output terminals. The resistance should be very high, a minimum of 500,000 (500k) Ohms. The weld control system may be grounded or malfunctioning. Perform the ***CONTROL POTENTIOMETER*** and ***MODE SWITCH TEST***, and the ***REMOTE RECEPTACLE RESISTANCE TEST.*** The Chopper module may be defective. Perform the ***CHOPPER MODULE RESISTANCE TEST.***

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
WELDING PROBLEMS		
The machine welds normally in all modes and the range of weld output seems normal, but one or both of the front panel displays is blank, incorrect welding value, or displays parts of numbers.	It is normal for one of the displays to be off when there is no load across the weld output terminals. In "CV" - mode only the "VOLTS" display will be illuminated, in all other modes only the "AMPS" display will be illuminated. When welding both displays should be reading actual welding parameters.	Both the "AMPS" and "VOLTS" displays use the same part numbered display unit. If one of the digital displays appears to be functioning normally, it can be used to test the weld control P.C. Board output to the malfunctioning display. Swap the display board connectors on the weld control board (they are both the same), if the good display functions normally in bad displays place then the P.C. Board is good and only the malfunctioning display should be replaced. If the known good display still malfunctions then the weld control P.C. board is defective and should be replaced.
A control cable type feeder does not function when connected to the 14 pin amphenol. Machine operates normally in the "CC-STICK" mode and has normal AC auxiliary output.	Check the circuit breaker CB1 if using a a120 Volt AC wire feeder. Check CB8 if using a 42 VAC wire feeder. Reset breaker in tripped. Check the Amphenol receptacle for damaged, corroded or dirty contact pins. The wire feeder control cable may be defective. The wire feeder may be defective.	Use a volt meter to check for the presents of supply voltage at the 14 pin Amphenol receptacle. 120 Volt AC power supplied through pins A and J, 421 VAC power is supplied through pins I and K. Perform the ***STATOR VOLTAGE TEST.***

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
An Across-the-Arc type wire feeder does not function when connected to the weld output of the machine. The Vantage® operated normally in the CC-STICK mode, and has normal AC auxiliary output.	Check that the welding terminals switch is in the "WELD TERMINALS ON" position. Check the that WELD MODE switch is in the correct position for the process being used, typically "CV-WIRE" mode. Check for poor weld cable connections between the feeder and the welder output terminal, and between the work and the other output terminal. Check that the wire feeder's work sensing lead is properly connected to the work piece and is in good condition. The wire feeder may be defective.	Use a voltmeter to check for the presence of about 58 VDC open circuit voltage (OCV) across the output studs of the machine. If the OCV is low, there may be a problem with the mode switch. Perform the ***CONTROL POTENTIOMETER AND WELD MODE SWITCH RESISTANCE TEST.*** If there is no OCV, see the troubleshooting sections for ***"No weld output in any mode".***
The engine will not crank when the start button is pushed.	Check the circuit breaker (CB5). Reset if tripped. Make sure the run/stop switch is in the "RUN" position. Check for loose or faulty battery cable connections. See wiring diagram. The battery may be low or faulty. If the battery will not accept a charge replace it. The starter or starter solenoid may be faulty (have the engine serviced at an authorized engine repair shop).	Check the wiring and the connections at the starter motor, glow plug button, CB5 circuit breaker, run / stop switch and the start button. See wiring diagram. Check the chassis ground connections between the engine block and the negative battery terminal. Place the run/stop switch to the "RUN" position. Press the start button, while checking for voltage between a good clean chassis ground connection (-) and lead #231 (+) at the starter solenoid. See the wiring diagram. If not voltage is present, check the start button, the run/stop switch and the CB5 circuit ground breaker. See wiring diagram. If battery voltage is present, the starter motor or solenoid may be defective, or the engine may be prevented from turning due a mechanical failure.

⚠ CAUTION

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PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The battery does not stay charged.	Check for loose, corroded, or faulty connections at the battery. Check for loose or damaged alternator drive belt. The battery may be faulty.	Perform the ***ENGINE ALTERNATOR TEST.*** There may be a defective component or faulty wiring, ,causing a current draw when the run/stop switch is in the "stop" position. Check the Run/Stop switch, the glow plug button, the alternator and the starter solenoid. Also check for damaged wiring and insulation. If the engine charging system is operating properly but the battery is not staying charged, the battery is defective and should be replaced.
The engine cranks when the start button is pressed but will not start.	The battery voltage may be low (normally results in slow cranking speed). The batter should be checked and recharged if it is not producing adequate voltage, and replace if it will not accept a full charge. Make sure the glow plug button is pressed while pressing the start button. See the operator's manual, or the operation section of this manual for proper starting procedure. Make sure the fuel valve on the fuel sediment filter is in the open position. Check that the machine has an adequate supply of fresh, clean fuel. The fuel filter may be clogged, replace if necessary. Check the oil level.	The fuel solenoid may be faulty or not operating properly. Check lead #233, and #262 and perform the ***FUEL SHUT DOWN SOLENOID TEST.*** The Engine Protection Board may be faulty. The engine may be in need of mechanical repairs.

⚠ CAUTION

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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine starts but shuts down immediately when the start button is released.	Make sure the glow plug button is pressed while pushing the start button, and held until the engine protection light turns off (5 SECONDS MAXIMUM AFTER THE ENGINE STARTS.). See the operator's manual, or the operating section of this manual for proper starting procedure. Check the oil level. Be certain that the engine is not overheated. Check that the machine had adequate supply of fresh, clean fuel. The fuel filter may be clogged. Replace if necessary.	The shut down fuel solenoid may be faulty or not operating properly. Check lead #233 and #262 and perform the ***FUEL SHUT DOWN SOLENOID TEST***. See wiring diagram. The check for the presents of 12 volts at the lead #233, when start button is pushed. Check CB5, and lead #231. The Engine Protection Board may be faulty. The engine may have inadequate oil pressure. The oil pressure switch or coolant temperature switch may be faulty.
The engine shuts down shortly after starting.	Check for adequate supply of clean fresh fuel. Check fuel and air filters, replace if necessary. Check oil level, add oil as required. Look for oil leakage. Check for loose or faulty battery cable connections.	The oil pressure switch or coolant temperature switch may be faulty. Make sure the engine has oil and oil pressure and engine is not overheated. Disconnect lead 234 from Engine Protection PC Board, of engine continues to run oil pressure switch or Temperature Switch is faulty. Check for faulty run/stop switch. Check for damaged insulation in the wiring between the engine protection relay and the oil pressure and coolant temperature switches. ***See wiring diagram.***

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine shuts down shortly after starting.		Check for poor electrical connections at the run/stop switch, and the fuel shutdown solenoid. ***See wiring diagram.*** The fuel solenoid may be faulty. Perform the ***FUEL SHUTDOWN SOLENOID TEST.***
The engine shuts down shortly after starting and trips the battery circuit breaker (CB5).	Try resetting the breaker. If it trips again do not attempt to use the machine. Contact a Lincoln Authorized Field Service Shop.	Repeated tripping and resetting of the circuit breaker can damage it, or alter its trip point. If the breaker has been ripped and reset many times, it should be replaced. Examine the CB5 circuit breaker, run/stop switch. Start button. Shut-down and idle solenoid, engine protection board, fuel gauge and sender, and all the wiring connecting these components. Look for damaged or out of place wiring that may be in contact with other conductors or chassis ground. ***See wiring diagram.*** Perform the ***IDLER SOLENOID TEST.*** Perform the ***FUEL SHUTDOWN SOLENOID TEST.*** The Engine Protection PC Board may be defective.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not develop full power.	The fuel may be old or contaminated. Supply the engine with clean fresh fuel. The fuel filter may be clogged, replace if necessary. The air filter may be clogged, replace if necessary.	The engine may be in need of adjustment or repair.
The engine will not idle down to low RPM. The machine has normal weld and auxiliary output.	Make sure the idle switch is in the "AUTO IDLE" position. Make sure there is no external load on the weld terminals or the auxiliary power receptacles. Check for mechanical restrictions in the idler solenoid linkage.	Perform the ***IDLER SOLENOID TEST.*** Check for damaged wiring or faulty connections at the idle solenoid, the engine protection PC Board, the run/stop switch and the start button. Check for loose or damaged wiring or faulty connections at leads #405 and #226, #227 and connections J,P-55-2 and J,P-55-4, (control PC board P2-5, and engine protection board, J32-2, B3, and J31-8). ***See wiring diagram.*** Set idle switch in the "AUTO" position. Set the mode switch to the "CC-STICK" position. Make sure that no load is applied to either the weld or auxiliary output Start the machine and allow it to run for about 30 seconds. Manually move the idle solenoid plunger to the idle position. If the solenoid engages and holds in the idle position, the idle pull coil may be bad.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not idle down to low RPM. The machine has normal weld and auxiliary output. **(continued)**		Manually move the idle solenoid plunger to the idle position. If the solenoid engages and holds in the idle position, the idle pull coil may be bad. If the solenoid does not hold in the low idle position, remove plug P6 from the control PC Board and wait about 30 seconds. If the engine drops to low idle check for damage or buildup of conductive material on or around the bypass filter assembly and the output terminals. ***See wiring diagram.*** If the engine still does not drop to low idle the control PC Board is probably defective. Replace it. Check that leads #3 and #6 are properly routed through the toroidal current sensor. Each lead must have two turns and must pass through the sensor in the opposite directions. ***See the wiring diagram***. The leads should be wrapped tightly and tie wrapped in place. Check the toroidal current sensor for any signs of damage. Check leads #260 and #261 for poor connections and damage to the conductors and insulation between the toroid current sensor and the P3 connector in the control PC Board. Unplug plug P3 from the control PC Board and check for damaged, dirty, or corroded pins.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not idle down to low RPM. The machine has normal weld and auxiliary output. **(continued)**		Measure the resistance of toroidal current sensor. Measure between #P-3 and #P-4, the resistance should be 4.1 Ohms. If the sensor is shorted or open replace it. The control board may be bad.
The engine will not go to high idle when using auxiliary power. Auxiliary power is normal when the idler switch is in the "HIGH" idle position, the automatic idle function works properly when welding.	The load on the auxiliary receptacle may be too low. The automatic idle system will not function reliably if the low is less than 100 Watts. The device connected to the auxiliary power may be defective try another device. Make sure the connections to the auxiliary device are tight. Some device are designed to sense for adequate input power. Product of this type may not turn on due to low voltage and frequency of the idling machine. If this happens the current draw will likely be insufficient to activate the automatic idle system. Device of this type may require that the Idler switch be in the "HIGH IDLE" position.	Check that leads #3 and #6 are properly routed through the toroidal current sensor. Each lead must have two turns and must pass through the sensor in the opposite directions. See wiring diagram. The leads should be wrapped tightly and tie wrapped in place. Check the toroidal current sensor for any signs of damage. Check leads #260 and #261 for poor connections and damage to the conductors and insulation between the toroid current sensor and the P3 connector in the control PC board. Unplug plug P3 from the control PC board and check for damaged, dirty, or corroded pins. Measure the resistance of the toroidal current sensor. Measure between #P-3 and P-4, the resistance should be 10-14 Ohms. If the sensor is shorted or open replace it. The control P.C. Board may be defective.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

Return to Section TOC
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Observe Safety Guidelines detailed in the beginning of this manual.

PROBLEMS (SYMPTOMS)	POSSIBLE AREAS OF MISADJUSTMENT(S)	RECOMMENDED COURSE OF ACTION
OUTPUT PROBLEMS		
The engine will not go to high idle when striking arc. The automatic idle system functions normally when using auxiliary power. Welding and auxiliary outputs are normal when the idle switch is in the "HIGH IDLE" position.	Check that the welding cables are in good working condition and the connections are tight. Make sure the work clamp is attached to clean, bare metal.	Check the leads and connections at the SHUNT at the Positive output stud. Check lead 204S and 206S for continuity from the shunt to J-6 on the Weld Control Board. Check the pins and connections at J-6 and J on the Weld Control Board. The weld control P.C. Board may be defective.
The engine will not go to high idle when attempting to strike and arc, or when a load is applied to any of the auxiliary power receptacles.	Check that the welding cables and the auxiliary power lead connections are tight.	The weld control P.C. Board may be defective.
The engine goes to low idle, but will not stay low idle.	Make sure there are no auxiliary loads on either the weld terminals or the auxiliary receptacles. Check that the welding cables and the auxiliary cables and the auxiliary power lead connections are tight and that the insulation is not damaged.	The Idler solenoid linkage may be damaged or out of adjustment. Make sure the solenoid plunger is able to fully ease against the internal stop of the solenoid coil assembly. The low idle RPM may be too low. Perform the ***ENGINE THROTTLE ADJUSTMENT TEST.*** The solenoid hold coil power circuit may be defective. Perform the ***IDLER SOLENOID TEST.*** The solenoid hold coil power circuit may be faulty. Check wiring and connections on lead #210A and lead #215. The weld control PC Board may be defective.

⚠ CAUTION

If for any reason you do not understand the test procedures or are unable to perform the tests/repairs safely, contact the Lincoln Electric Service Department for technical troubleshooting assistance before you proceed. Call 1-888-935-3877.

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This procedure will aid the technician in the removal and replacement of the case sheet metal covers.

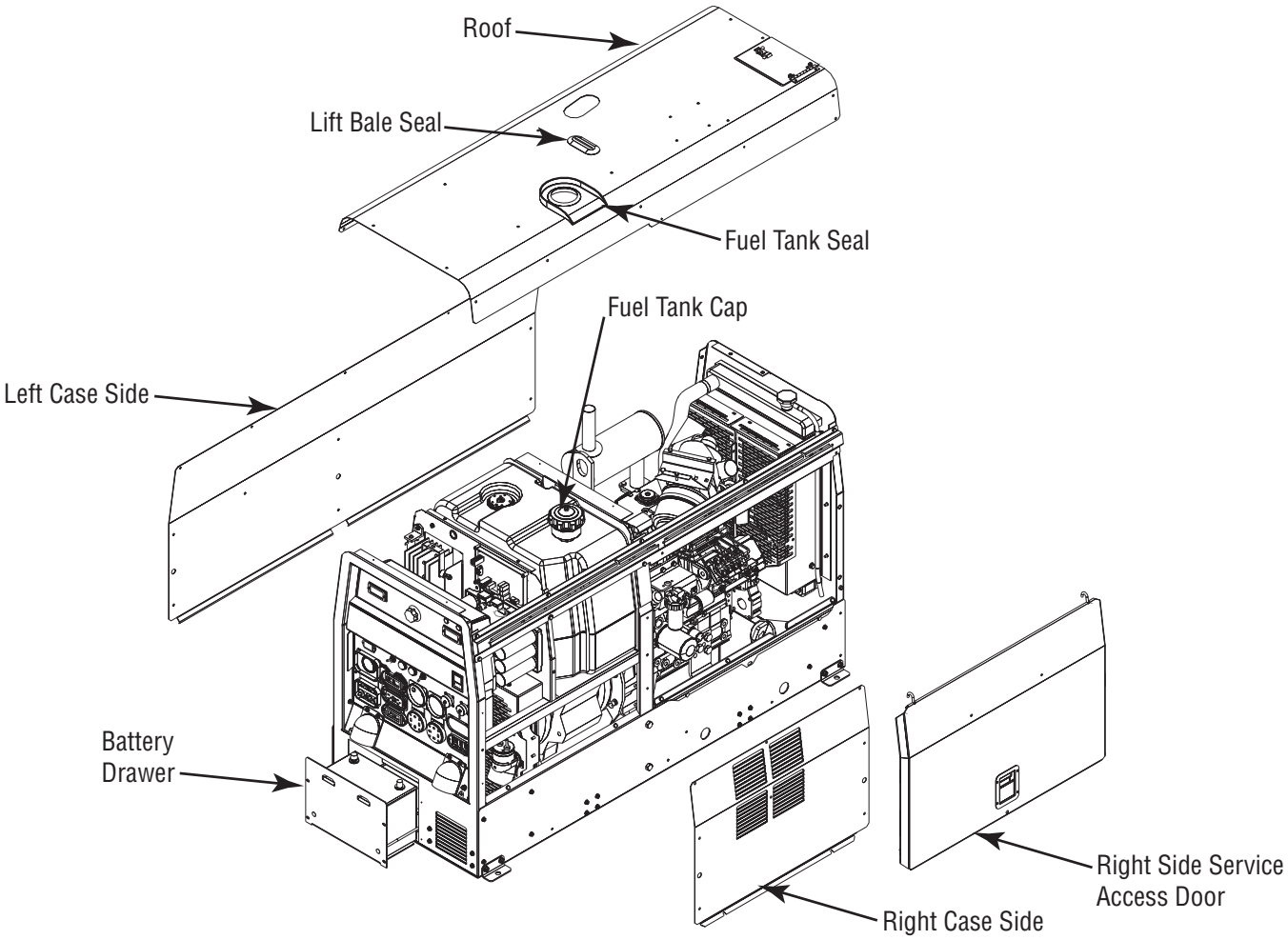
MATERIALS NEEDED

3/8" wrench

1/2" wrench

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE (CONTINUED)

FIGURE F.1 – DOOR REMOVAL



PROCEDURE

1. Turn the engine off.
2. Using the 3/8" wrench, remove the battery cover. Slide the battery out and disconnect the negative battery cable.
3. Unlatch and open the right side service access door. See Figure F.1.
4. Slide the door back 8” to notch in rail. Lift left hinge from track. Slide door forward 2” to notch in rail and lift right hinge from track.
5. Remove access door.
6. With the 1/2” wrench, remove the exhaust pipe rain cap.
7. Remove the fuel tank cap, gasket, and the lift bail cover seal.
8. Remove the screws mounting the roof in place.
9. With the help of an assistant, carefully remove the roof. Replace the fuel cap.
10. With the 3/8” wrench, remove the right case side and the left case side. See Figure F.1.

CASE COVER REMOVAL AND REPLACEMENT PROCEDURE (CONTINUED)

REASSEMBLY PROCEDURE

1. Install components in reverse order of removal.
2. Be sure components align correctly.
3. Reconnect battery and replace battery door.

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CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

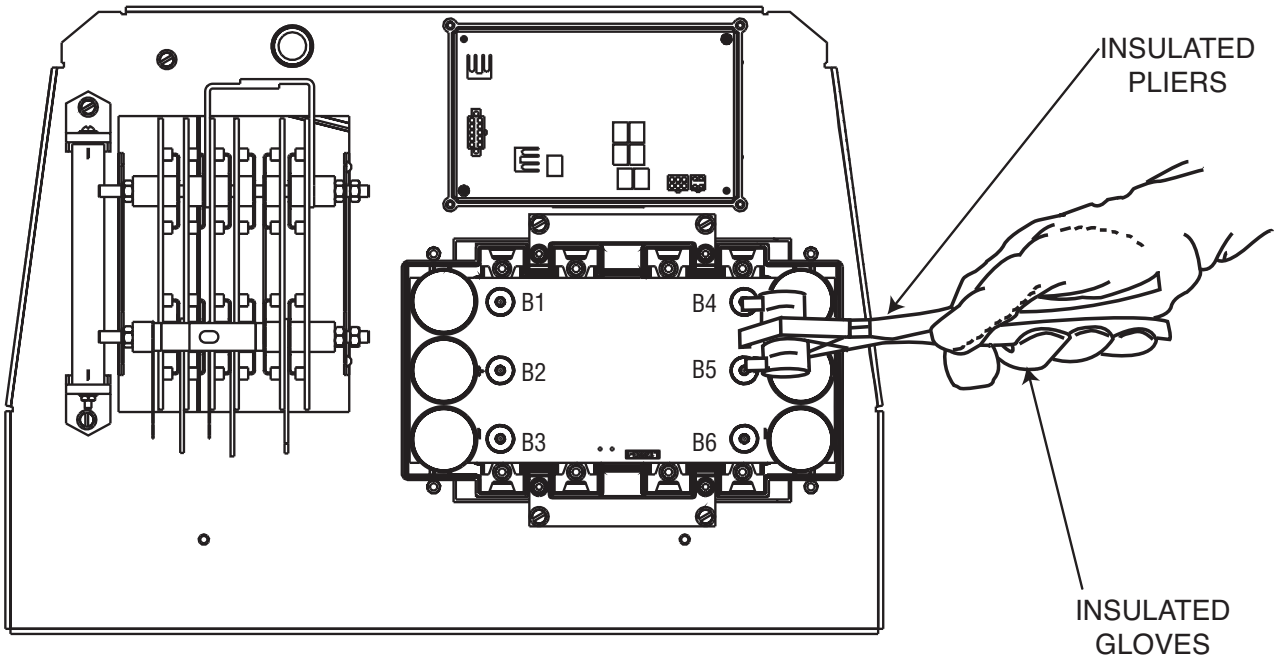
This procedure will insure that the large capacitors in the chopper module have been discharged. This procedure should be performed whenever work is to be attempted on or near the chopper module.

MATERIALS NEEDED

Miscellaneous hand tools
Volt/Ohmmeter
Resistor (25-1000 ohms and 25 watts minimum)
    Lincoln part #S10404-114 works well for this purpose
Jumper leads
Wiring Diagram

CHOPPER MODULE CAPACITOR DISCHARGE PROCEDURE (CONTINUED)

FIGURE F.2 - CHOPPER MODULE CAPACITOR TERMINAL DISCHARGE



⚠ WARNING

ELECTRIC SHOCK can kill.

- Do not touch electrically hot parts.
- Prior to performing preventative maintenance, perform the following capacitor discharge procedure to avoid electric shock.

DISCHARGE PROCEDURE

1. Turn the engine off.
2. Perform the ***Case Cover Removal*** procedure.

NOTE: It is necessary to remove the fuel cap in order to take the case cover off the machine. Be sure the fuel cap is **ON** when discharging the chopper module capacitors.

3. Locate the chopper module and capacitor assembly on the inner machine baffle. See Figure F.2 and the Wiring Diagram.

NEVER USE A SHORTING STRAP TO DISCHARGE CAPACITORS. If the Lincoln recommended resistor, or an equivalent resistor is used, the capacitors can be discharged by holding the resistor with insulated pliers and using the resistor terminals to bridge Chopper Module terminals B1 to B2, and B4 to B5. DO NOT TOUCH THE TERMINALS OR METAL PARTS OF THE PLIERS WITH YOUR BARE HANDS. Hold the resistor in place for about 10 seconds.

If another type of resistor is used, jumper leads may need to be attached to the resistor. The leads can then be used to connect terminals B1 to B2, and B4 to B5.

4. Using the volt/ohmmeter, check the voltage across B1 and B2, then B4 and B5. It should be zero volts in both cases.

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FUEL SHUTDOWN SOLENOID TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

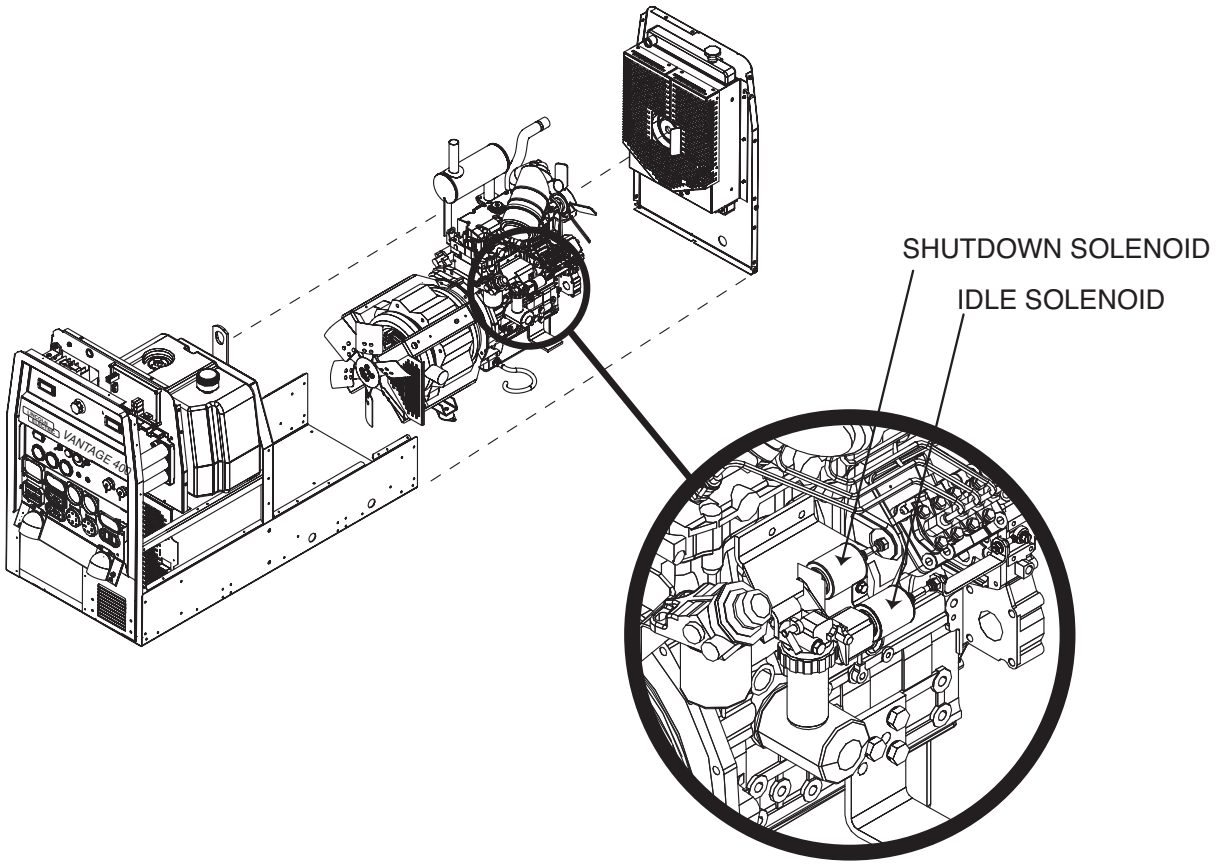
This test will determine if the shutdown solenoid resistance values are normal, and also determine if it will function normally when energized with 12 VDC.

MATERIALS NEEDED

Wiring Diagram
Volt/Ohmmeter
Miscellaneous hand tools
12 volt D.C. power source, (an automotive battery works well)

FUEL SHUTDOWN SOLENOID TEST (CONTINUED)

FIGURE F.3 - FUEL SHUTDOWN SOLENOID LOCATION



TEST PROCEDURE

1. Turn the engine off.
2. Open the right side engine service access door.
3. Locate the fuel solenoid, located on top of the engine.
4. Locate and unplug harness connection 56. Cut any necessary cable ties. ***See Figure F.4.*** See Wiring Diagram.
5. Check the coil resistance, (black wire to red wire). The normal resistance is approximately 9 ohms. Check the Resistance between the black wire and a clean, unpainted chassis ground. The resistance should be very high, 500,000 Ohms or more. If any of the above resistance values are incorrect, the solenoid may be faulty. Replace.
6. Using an external 12VDC supply, apply voltage to the coil leads, (black-) to (white+). The solenoid should activate.

   If the solenoid does not operate correctly when 12VDC is applied, the solenoid may be defective. Replace.

   Re-connect fuel solenoid and replace any previously removed cable ties.
7. If finished testing, close the engine service access doors.

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ENGINE THROTTLE ADJUSTMENT TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

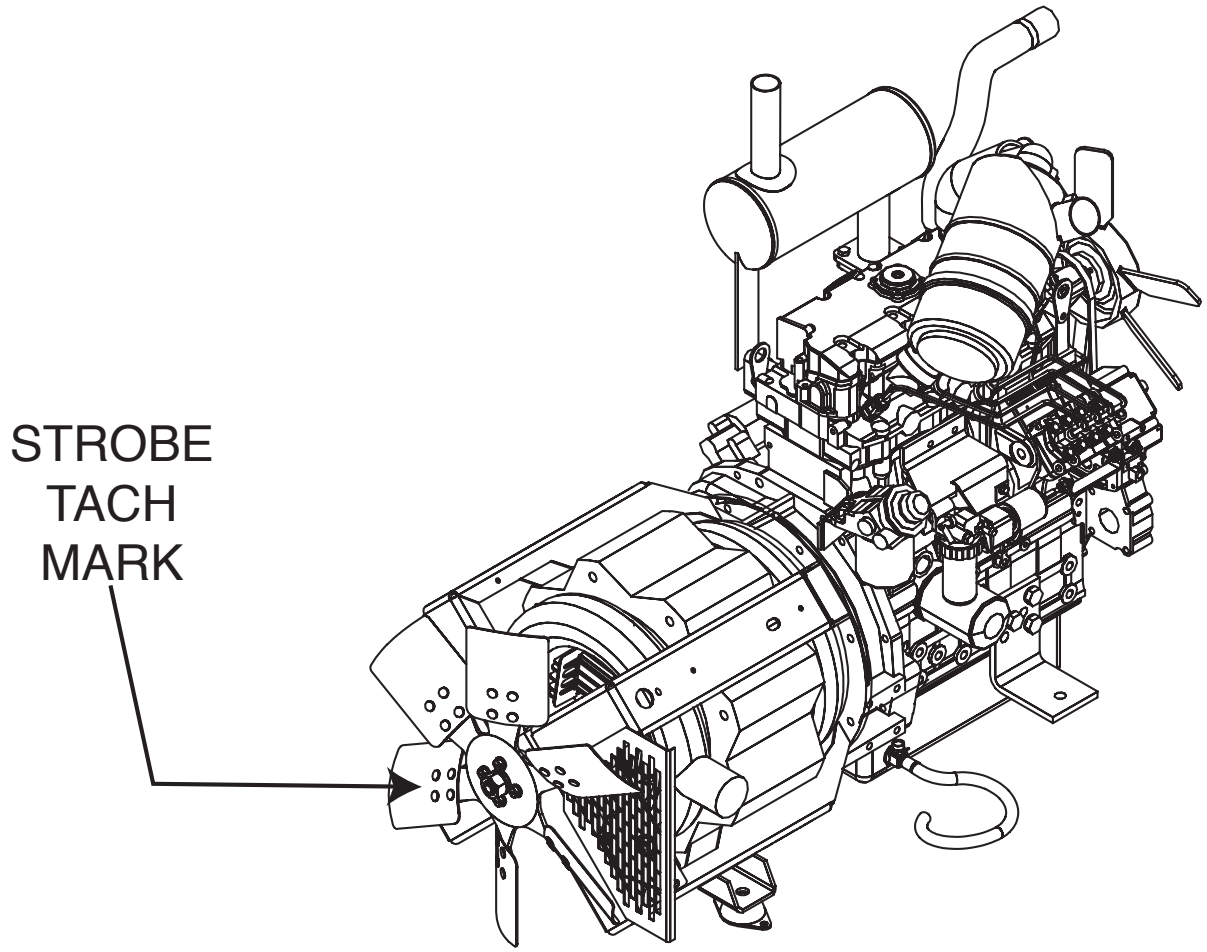
If the machine output is low or high, this test will determine whether the engine is operating at the correct speed (RPM) during both HIGH and LOW idle conditions. You can check RPM using a strobe-tach, a frequency counter, or a vibratach. Directions for adjusting the throttle to the correct RPM are given.

MATERIALS NEEDED

Miscellaneous hand tools and metric wrench set
High visibility marker
Strobe-tach, frequency counter, or vibratach

ENGINE THROTTLE ADJUSTMENT TEST (CONTINUED)

FIGURE F.4 - STROBE MARK LOCATION



TEST PROCEDURE

Strobe-Tach Method

1. Turn the engine off
2. open the top and right side engine service access doors.
3. Place a highly visible mark on the engine cooling fan blade. See Figure F.4.
4. Connect the strobe-tach according to the manufacturer's instructions.
5. Start the engine and place the idle switch in the "HIGH IDLE" position. Make sure that there is no load on the machine.
6. Direct the strobe-tach light on the fan blade that had been marked earlier, and synchronize the light with the rotating mark. See the strobe-tach manufacturer instructions.

   The tach should read between 1860 and 1890 RPM.
7. Move the idle switch to the "AUTO IDLE" position and wait for the idle solenoid to energize, and the engine RPM to drop and stabilize at the low idle RPM.
8. Synchronize the strobe-tach to read the low idle RPM.

   Low idle speed should be 1300-1400 RPM.

   If either of the readings is incorrect, proceed to the ***THROTTLE ADJUSTMENT PROCEDURE*** later in this section.

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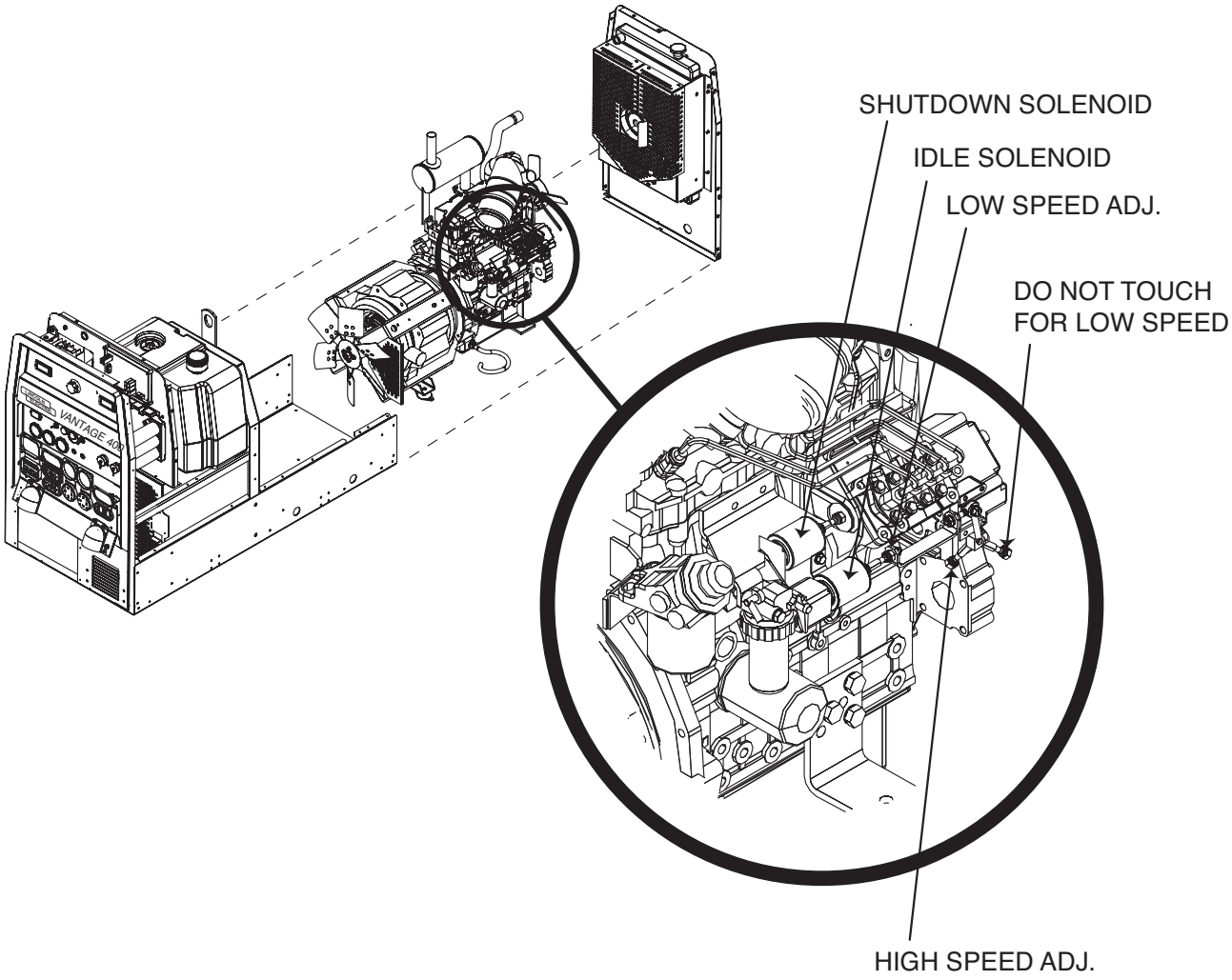
ENGINE THROTTLE ADJUSTMENT TEST (CONTINUED)

FIGURE F.5 - SOLENOID



Frequency Counter Method

NOTE: A dedicated frequency counter can be used for this test, but many high quality digital multimeters also have this function, and can be easily utilized. See the manufacturer instructions for your frequency counter or multimeter.

1. Set your frequency counter per the meter manufacturer instructions, and plug it into one of the 120VAC auxiliary receptacles.
2. Start the engine and place the idle switch in the "HIGH IDLE" position. Make sure that there is no load on the machine.

   The frequency should read between 62.0 and 63.0 Hz.
3. Move the idle switch to the "AUTO IDLE" position and wait for the idle solenoid to energize, and the engine RPM to drop and stabilize at the low idle RPM.

   The frequency should read between 43.3 and 46.6 Hz.

   If either of the readings is incorrect, proceed to the ***THROTTLE ADJUSTMENT PROCEDURE*** later in this section.

NOTE: For the VANTAGE® 400, and any other Lincoln Electric 1800 RPM (4 Pole) machine, engine RPM can be determined by multiplying the frequency, in Hz. By 30. (Example: 30 Hz * 62 = 1860RPM)

ENGINE THROTTLE ADJUSTMENT TEST (CONTINUED)

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Vibratach Method

A Vibratach is used to measure the vibrations caused by the running engine. It can be positioned anywhere where the engine vibration is reasonably strong. The best results will likely be obtained by opening the top engine cover and placing the Vibratach directly against the top of the engine.

Read and understand the manufacturer's instructions for the Vibratach.

1. Start the engine and place the idle switch in the "HIGH IDLE" position. Make sure that there is no load on the machine.
2. Position and adjust the Vibratach; it should read between 1860 and 1890 RPM.
3. Move the idle switch to the "AUTO IDLE" position and wait for the idle solenoid to energize, and the engine RPM to drop and stabilize at the low idle RPM.
4. Position and adjust the Vibratach; it should read between 1300 and 1400 RPM.

   If either of the readings is incorrect, proceed to the "THROTTLE ADJUSTMENT PROCEDURE".

THROTTLE ADJUSTMENT PROCEDURE

IMPORTANT: Both the high and low idle settings are adjusted at the solenoid.

1. Check that the linkage attaching the solenoid to the engine speed control lever is properly aligned and in good condition. It is more important that the solenoid linkage be more precisely aligned when in the high speed (de-energized position).
2. Check to be sure the spring located inside the rubber boot is not broken or missing. In the default, (de-energized) position the spring should be holding the solenoid in the high speed position. ***See Figure F.5.***

NOTE: Low idle RPM must be set, and the adjustment nuts tightened, before the high idle RPM is adjusted.

Low Idle adjustment:

1. With engine running and no load applied to the machine, place the idle switch in the "AUTO IDLE" position. Wait for the idle solenoid to energize and the engine speed to drop and stabilize to low idle RPM.
2. If the low idle RPM requires adjustment, loosen the low idle adjustment jam nuts. Turn both nuts so they are clear of the swivel fitting. Rotate the swivel fitting until the engine speed has been set to between 1200 and 1400 RPM. Hold the swivel fitting in position while tightening the first jam nut against the swivel fitting, and then tighten the second jam nut against the first. Do not adjust at engine stop lever.
3. Re-check the low idle RPM, and then proceed to the high idle adjustment.

High idle adjustment:

1. With engine running, place the idle switch in the "HIGH IDLE" position. The solenoid should immediately de-energize, allowing the engine to increase to high idle speed.
2. If the high idle RPM requires adjustment, loosen the high idle adjustment screw jam at engine lever + high speed stop nut and turn the adjusting screw until the engine speed is between 1860 and 1890 RPM. Hold the adjusting screw in position while tightening the jam nut against the solenoid plunger.
3. Re-check the high idle RPM.
4. Close the engine service access doors and shut off the engine.

IDLER SOLENOID TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

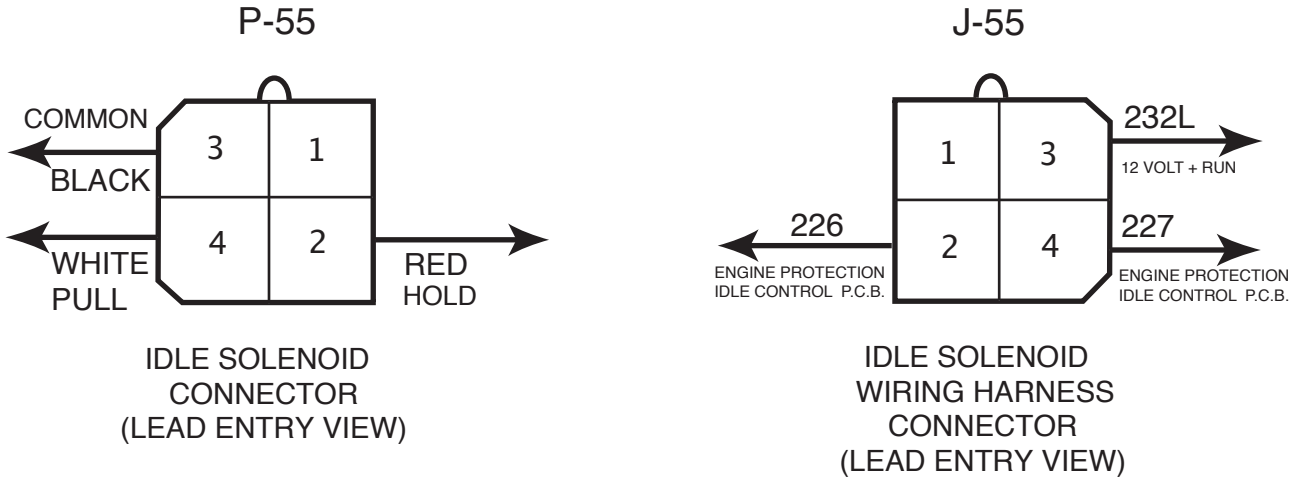
This test will determine if the idler solenoid resistance values are normal, and also determine if it will function normally when it is energized with 12VDC.

MATERIALS NEEDED

Miscellaneous hand tools
External 12VDC supply (30 amps) (automotive battery works well)
Wiring Diagram
Volt/Ohmmeter

IDLER SOLENOID TEST (CONTINUED)

FIGURE F.6 - PLUG(S) PIN LOCATION



TEST PROCEDURE

1. Turn the engine off.
2. Open the right side engine service access door.
3. Locate the idler solenoid mounted right side of engine.
4. Locate and unplug harness connection P-55. Cut any necessary cable ties. See Wiring Diagram.
5. Using the volt/ohmmeter, check the pull-in coil resistance, pins 3 and 4 (black wire to white wire). The normal resistance is less than 0.2 ohms. Check the hold-in coil resistance, pins 3 and 2 (black wire to red wire). The normal resistance is approximately 11 ohms. Check the resistance between pin 3 (black wire) and a clean, unpainted chassis ground. The resistance should be very high. 500,000 Ohms or more. If any of the above resistance values are incorrect, the solenoid may be faulty. Replace. See Figure F.6.
6. Using the external 12VDC supply, apply 12VDC to the pull-in coil leads at pins 3+ and 4- (black wire to white wire). The solenoid should activate. REMOVE THE VOLTAGE IMMEDIATELY to avoid damage to the unit.

   Apply 12VDC to the hold-in coil at pin #3 (black wire +) and pin #2 (red wire -). While the voltage is applied, manually move the solenoid to the low idle position. The solenoid plunger should hold this position until the voltage is removed. See Figure F.6.
7. If either coil does not operate as described, check for mechanical restrictions or other problems with the linkage.
8. If the linkage is intact and the solenoid does not operate correctly when the 12VDC is applied, the solenoid may be faulty. Replace.
9. Re-connect idle solenoid and replace any previously removed cable ties.
10. If finished testing, close the engine service access door.

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ENGINE ALTERNATOR TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

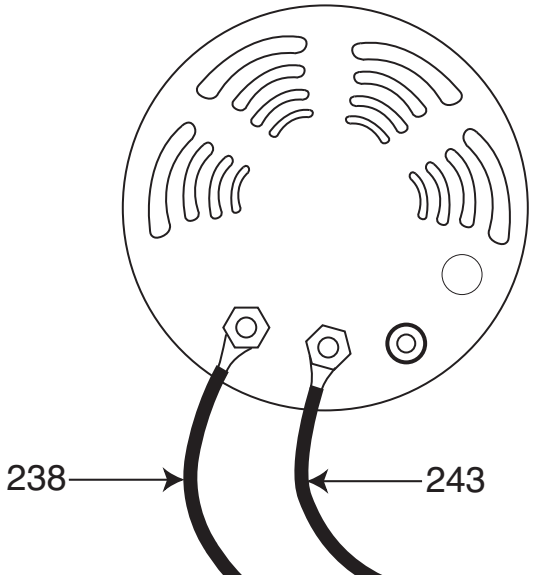
This test will determine if the engine alternator is properly charging the battery.

MATERIALS NEEDED

Miscellaneous hand tools
Volt meter
Wiring Diagram

ENGINE ALTERNATOR TEST (CONTINUED)

FIGURE F.7 - LEAD LOCATIONS



TEST PROCEDURE

1. Turn the engine off.
2. Open the engine access door and check the voltage at the battery terminals. It should be approximately 12 volts DC.
3. Attach the meter leads to the battery terminals, being careful to position them so they stay clear of moving parts while the engine is running.
4. Place the idle switch in the “HIGH IDLE” position, start the engine, and allow it to run at high idle speed for about 15 to 30 seconds.
5. The meter should read about 13.7 to 14.2 VDC.
6. If the meter reads correctly the engine alternator is producing adequate power to charge the battery and this test is complete.
6. If the voltage is significantly higher than the above values, the alternator is not properly regulating the battery charging voltage and should be replaced. If the voltage reads the same or less than the measurement taken when the engine was not running, proceed with the following tests.
7. Turn off the engine, disconnect the meter from the battery, and open the engine access door on the left side of the machine.
8. Make sure the idle switch is still in the “high” position, start the engine, and allow it to run at high idle speed for about 15 to 30 seconds.
9. Place the negative meter probe on a good chassis ground, or the negative battery terminal. Place the positive meter probe on the battery terminal on the back of the alternator. (Lead #238) See Figure F.7. See Wiring Diagram.
10. The meter should read about 13.7 to 14.2 VDC.
11. Move the positive probe to the DT terminal on the back of the alternator. (Lead 243C) See Figure F7.
12. The meter should read about 13.7 to 14.2 VDC.
13. If the meter reads correctly, check the connections between the alternator and the battery. See wiring diagram.
14. If the voltage at both of the above test points reads the same or less than the battery voltage measurement taken when the engine was not running, the alternator is defective. Repair or replace it.

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BRUSH AND SLIP RING SERVICE PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

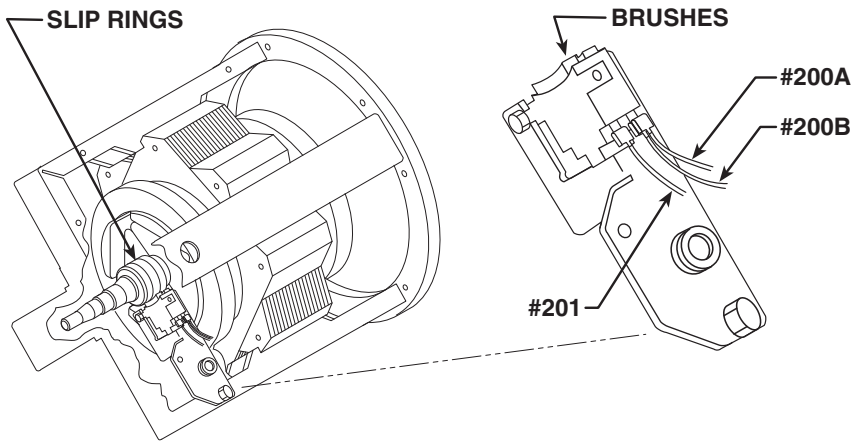
This procedure provides guidance in testing and maintaining the brush and slip ring system.

MATERIALS NEEDED

Volt/Ohmmeter
Miscellaneous hand tools
500 or 600 grit emery cloth
180 grit sand paper

BRUSH AND SLIP RING SERVICE PROCEDURE (CONTINUED)

FIGURE F.8 – BRUSH & SLIP RING LOCATIONS



TEST PROCEDURE

1. Perform the ***Case Cover Removal Procedure***

2. Examine brushes and slip rings. The slip rings, brush holder, and brushes should be clean and free from oil or grease. The brushes should be making good, continuous contact with the slip rings.

3. The brushes should be of sufficient length and have adequate spring tension. Generally, the brushes should be replaced if either brush has less than 1/4" remaining before it reaches the end of its travel. Spring tension should be sufficient to hold the brushes firmly against the slip rings.

4. The brushes should be removed from the brush holder and examined. The terminals should be clean. The shunt, (braided lead connecting the carbon brush to the terminal) should be in good condition and firmly connected to the carbon brush and to the connection terminal.

5. If the slip rings are discolored, display evidence of excessive sparking, or the brushes have worn prematurely; these may be signs of a grounded or shorted rotor. Perform the ***rotor resistance test***.

6. Check for evidence of sticking brushes. Sticking brushes will normally result in the slip rings being pitted and discolored from excessive arcing. Another sign of sticking brushes is instability or loss of both weld and auxiliary output, but the machine may begin to work properly, for a short time, after being jarred or moved.

7. If there is any evidence that the brushes may have been sticking in the brush holders, a new brush holder and brush assembly should be installed.

Cleaning slip rings:

1. In the event that the slip rings have become dirty, discolored or mildly pitted, it will be necessary to clean them, using very fine, 500 or 600 grit sand paper or a 220 or 320 grit commutator stone.

Seating Brushes:

1. If brushes have been replaced, repositioned, or are not making full contact with the slip rings, it may be necessary to re-seat them. This can be done by placing a strip of 180 grit sandpaper between the slip rings and the brushes, with the abrasive side against the brushes. Pull the sandpaper strip around the circumference of the slip rings in the direction of rotor rotation only. Repeat this procedure until the surface of each brush is in full contact with its matching slip ring.

2. Use a low pressure compressed air to thoroughly blow the carbon, commutator stone, and sandpaper dust from the machine before operating.

3. Perform the ***Case Cover Replacement Procedure***

Note: See Figure F.8 for general locations.

ROTOR RESISTANCE AND GROUND TEST (STATIC)

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the rotor winding is open, shorted, or grounded.

MATERIALS NEEDED

Miscellaneous hand tools
Ohmmeter Analog type meter required for dynamic resistance test.)
Wiring Diagram

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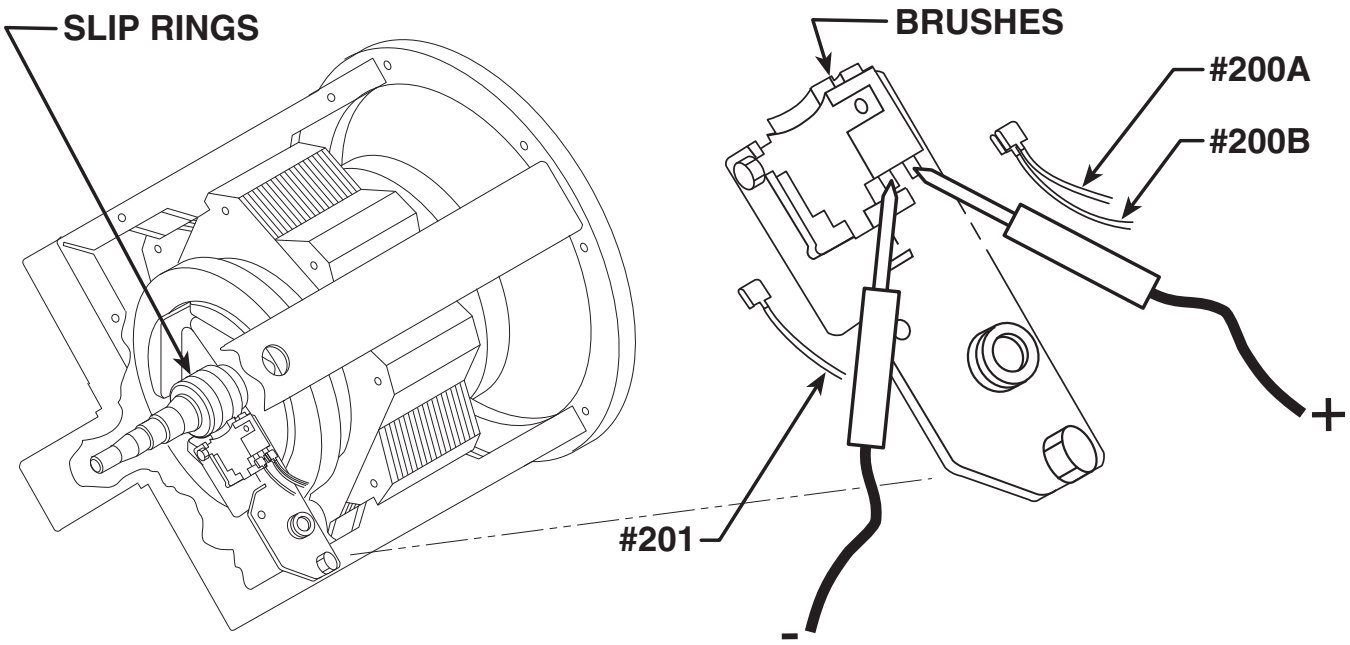
ROTOR RESISTANCE AND GROUND TEST (STATIC) (CONTINUED)

FIGURE F.9 - ROTOR BRUSH LEADS



TEST PROCEDURE

1. Turn the engine off.
2. Perform the ***Case Cover Removal*** procedure.
3. Locate and label the leads from the rotor brush holder assembly. See Figure F.9. Using the needle nose pliers, remove the leads. This will electrically isolate the rotor windings.
4. Using the ohmmeter, check the rotor winding resistance across the slip rings. See Figure F.9. Normal resistance is approximately 25 ohm, at 77° F. (25° C.).
5. Measure the resistance to ground. Place one meter probe on either of the slip rings. Place the other probe on any good unpainted chassis ground. The resistance should be very high, at least 500,000 (500k) ohms.
6. If the test does not meet the resistance specifications, then the rotor may be faulty and should be replaced.
7. If this test meets the resistance specifications, continue testing using the dynamic rotor resistance and ground test.

ROTOR RESISTANCE AND GROUND TEST (DYNAMIC)
(Also referred to as flying resistance test)

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test checks for faults in the rotor winding, while these windings are being stressed by the mechanical forces encountered during normal operation.

MATERIALS NEEDED

Miscellaneous hand tools
Ohmmeter Analog type meter required for dynamic resistance test.)
Wiring Diagram

Note: This test is best performed with a good quality analog type ohmmeter. Many digital meters will not provide stable or accurate Resistance readings while the rotor is spinning.

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ROTOR RESISTANCE AND GROUND TEST (DYNAMIC) (CONTINUED)

TEST PROCEDURE

This test requires that the brushes and slip rings are clean, in good condition, and are properly seated.

1. Perform the ***brush and slip ring service procedure*** if necessary.

2. Insulate the lead wires that had been disconnected from the brushes during the static rotor resistance test. Position and secure them so they cannot become damaged by the spinning rotor.

3. Securely attach the ohmmeter leads to the brush terminals. Use clips or terminals to attach the leads **BEFORE** starting the engine.

4. Start the engine and run it at high idle speed (1860-1890 RPM). The resistance should read approximately 25Ω at 77ºF (25º C.)

4. Shut off engine, and move one of the ohmmeter leads to a good clean chassis ground.

5. Restart the engine and run it at high idle speed (1860-1890 RPM). The resistance should be very high, at least 500,000 (500k) ohms.

6. If the resistance readings differ significantly from the values indicated, re-check the brushes and the brush spring tension. If the brushes and slip rings are good, replace the rotor.

7. If all testing is finished, perform the ***Case Cover Replacement*** procedure.

***NOTE:** The resistance of the windings will change with temperature. Higher temperatures will produce higher resistance, and lower temperatures will produce lower resistance.

ROTOR VOLTAGE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

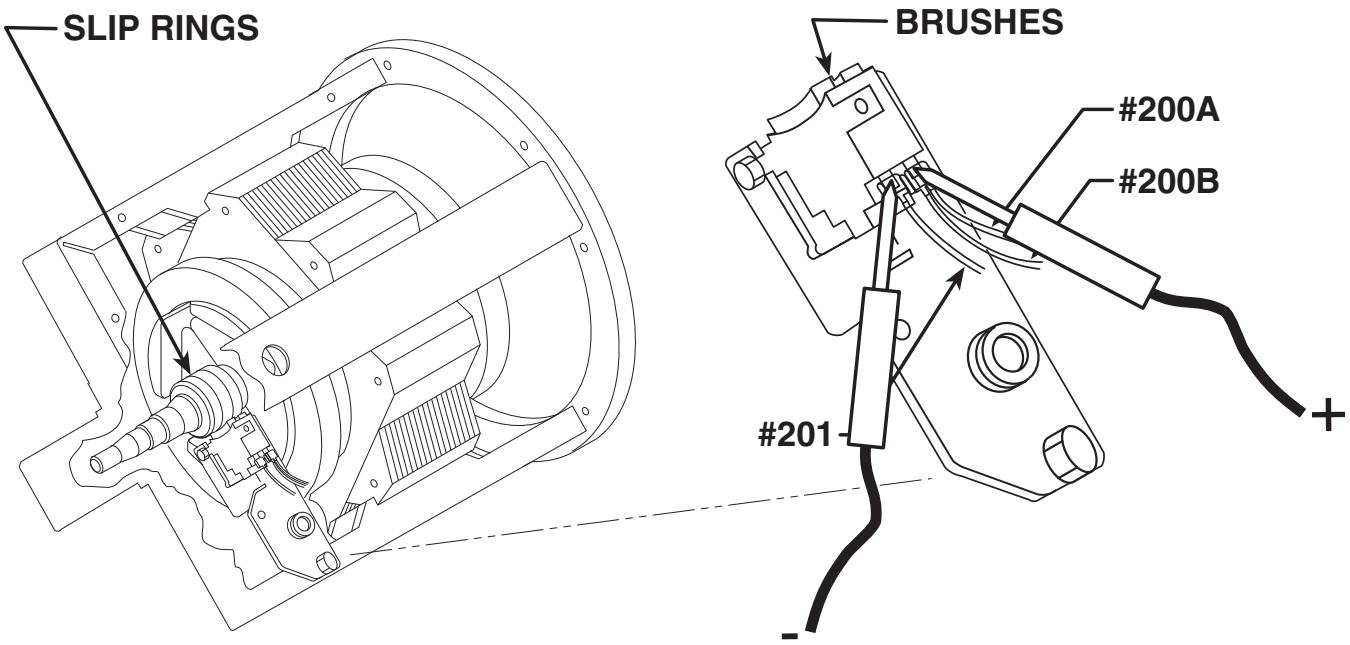
This test will determine if the rotor winding is operating at normal charge.

MATERIALS NEEDED

Miscellaneous hand tools
Voltmeter
Wiring Diagram

ROTOR VOLTAGE TEST (CONTINUED)

FIGURE F.10 - LEAD LOCATIONS



TEST PROCEDURE

1. Perform the ***Case Cover Removal*** procedure.
2. Connect the voltmeter probes to the brush terminals. See Figure F.10. See the wiring diagram.
3. Set the RUN/STOP switch to "RUN" and the IDLE switch to "HIGH". Start the engine and allow the RPM to stabilize for about 15 to 30 seconds.

   The meter should read 145 to 175 VDC.
4. Set the RUN/STOP switch to "STOP"
5. If the meter reading is normal, this test is complete.
6. If the voltage measures zero or very near zero, the rotor flashing circuit may be faulty or the rotor may be shorted.
7. Perform the ***Rotor Resistance and Ground Test*** and the ***Flashing Voltage Test***.
8. **If voltage is higher than 175 VDC**, the engine RPM may be too high, or there may be voltage intrusion from one of the higher voltage stator windings to the stator exciter winding. Perform the ***Engine Throttle Adjustment Test***, and the ***Stator Short Circuit and Ground Test***.
9. **If the voltage is lower than 145, but higher than 120**, the engine RPM may be too low, or there may be problems in the windings or other exciter circuit components or connections. Perform the ***Engine Throttle Adjustment Test***, and then perform the testing described below, under the heading ***"If the voltage measures about 3 to 5 VDC"***

ROTOR VOLTAGE TEST (CONTINUED)

10. **If the meter reading indicates battery voltage, about 12 to 14 VDC**, the rotor may be open, or the brushes may be faulty or not making proper contact with the slip rings. Perform the ***Rotor Resistance Test***, and ***Brush and Slip Ring Service Procedure***.
11. **If the voltage measures about 3 to 5 VDC**, the generator is not building-up to normal output even though the flashing circuit appears to be functioning normally. This condition could be caused by one of several failed components or connections. Continue with the following test.
12. Check the field bridge rectifier, and capacitor; also check the wiring and terminals connecting them. See the wiring diagram.
13. Perform the ***Rotor Resistance Test***.
14. Perform the ***Stator Short Circuit and Ground Test***.
15. When the Stator short circuit and ground test has been completed, reconnect leads 6 and 5H to the field bridge rectifier, (D3). All other stator leads should remain disconnected and isolated at this time.
16. Be sure that there are no leads of any kind across any of the stator windings, except the 6A - 5H winding. Examine stator wiring for damage, pinched leads, chafed insulation, etc. If necessary, disconnect and isolate the stator output leads as close to the starter as possible. See wiring diagram.
17. All of these disconnected leads should be insulated, and/or positioned so they cannot come in contact with any other wiring or chassis ground and cannot be damaged by moving parts when the engine is running.
18. Re-start the machine and measure the rotor voltage.
19. If rotor voltage continues to read significantly lower than 120 VDC, the Stator is probably defective and should be replaced.

Note: The field bridge rectifier and field capacitor may appear to function normally when tested independently, but may malfunction when placed under the stress or normal operation. For this reason, It is recommended that the bridge rectifier and the capacitor be replaced with known good components before replacing the stator.

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FLASHING VOLTAGE TEST
(Engine Not Running)

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test checks the flashing voltage with the engine stopped, by simulating a running condition.

MATERIALS NEEDED

Miscellaneous hand tools
Voltmeter
Wiring Diagram

FLASHING VOLTAGE TEST (CONTINUED)

TEST PROCEDURE

1. Perform the ***Case Cover Removal Procedure***.

2. Make sure that the battery is fully charged and in good condition, and the battery connections are clean and tight.

3. Remove leads 234 and 235 from the oil pressure switch. Insulate or position the lead so it cannot come in contact with chassis ground or any other wiring. See Wiring Diagram.

NOTE: Disconnecting leads 234 and 235 bypass the oil-pressure switch and simulates a running engine.

4. Place the RUN/STOP switch in the "RUN" position. (The engine protection light should remain off.)

5. **Connect the voltmeter probes to brush terminals.**

6. Measure the voltage; it should read about 3 to 5 VDC.

7. Set the RUN/STOP switch to the "STOP" position.

8. **If the meter reads normal voltage of 3 to 5 VDC**, this test is complete.

9. If the meter reading indicates battery voltage, about 12 to 14 VDC, The rotor may be open, or the brushes may be faulty or not making proper contact with the slip rings.

10. Perform the ***Rotor Resistance Test***. ***Perform the Brush and Slip Ring Service Procedure***.

11. If the voltage measures zero or very near zero; this condition could be caused by a poor connection or a defective component in the flashing circuit, or a shorted rotor winding.

12. Perform the ***Rotor Resistance Test***.

11. Refer to the wiring diagram, pull plug P-23 from the control PC board and inspect each terminal. Make sure that all terminals both on the board and in the plug are clean and in good condition, and that the pins are securely crimped to the flex leads. Perform the following additional test.

13. Switch the RUN/STOP switch to the "RUN" position.

14. Use a voltmeter to check for the presents of about 12VDC, battery voltage, at the following locations on the engine protection/ idle control p.c.b.

(-) Lead #5S (B1) to (+) Lead #232 (J31-1)

(-) Lead #5S (B1) to (+) Lead #232F (J31-2)

(-) Lead #5S (B1) to (+) Lead #200 (J33-5)

NOTE: Lead #232 supplies 12VDC battery voltage to the engine protection PC board whenever the run/stop switch is in the run position.

Lead #200 supplies DC flashing voltage from the control PC board to the positive slip ring through.

15. **If battery voltage is present at all of the above points; check the top grounding stud on inside left case from and lead #5H, also check leads #200, #200B, R3. Make sure all terminals are crimped tightly to the flex leads and arc free of corrosion.**

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FLASHING VOLTAGE TEST (CONTINUED)

16. If battery voltage is present at leads #232 and #232F, but not present at leads #200 The engine protection / idle P.C.B. board is probably defective. Replace.

17. If battery voltage is present at lead #232, but not present at leads #232F or #200 check the engine protection wiring per the wiring diagram.

18. If battery voltage is not present at lead #232, check wiring per wiring diagram, and check the run/stop switch. Also check the ground PC board chassis ground wire, lead #5K and the stud where it connects to the chassis.

19. Set the RUN/STOP switch to the “STOP” position.

20. Re-connect lead #234 to the oil pressure switch.

21. If testing is completed, perform the ***Case Cover Replacement*** procedure.

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STATOR VOLTAGE TESTS

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the stator is able to produce correct voltage from of its windings. It will only yield meaning data if the engine high idle speed is correct, (1860 to 1890 RPM), and approximately 160 VDC is present across the rotor slip rings.

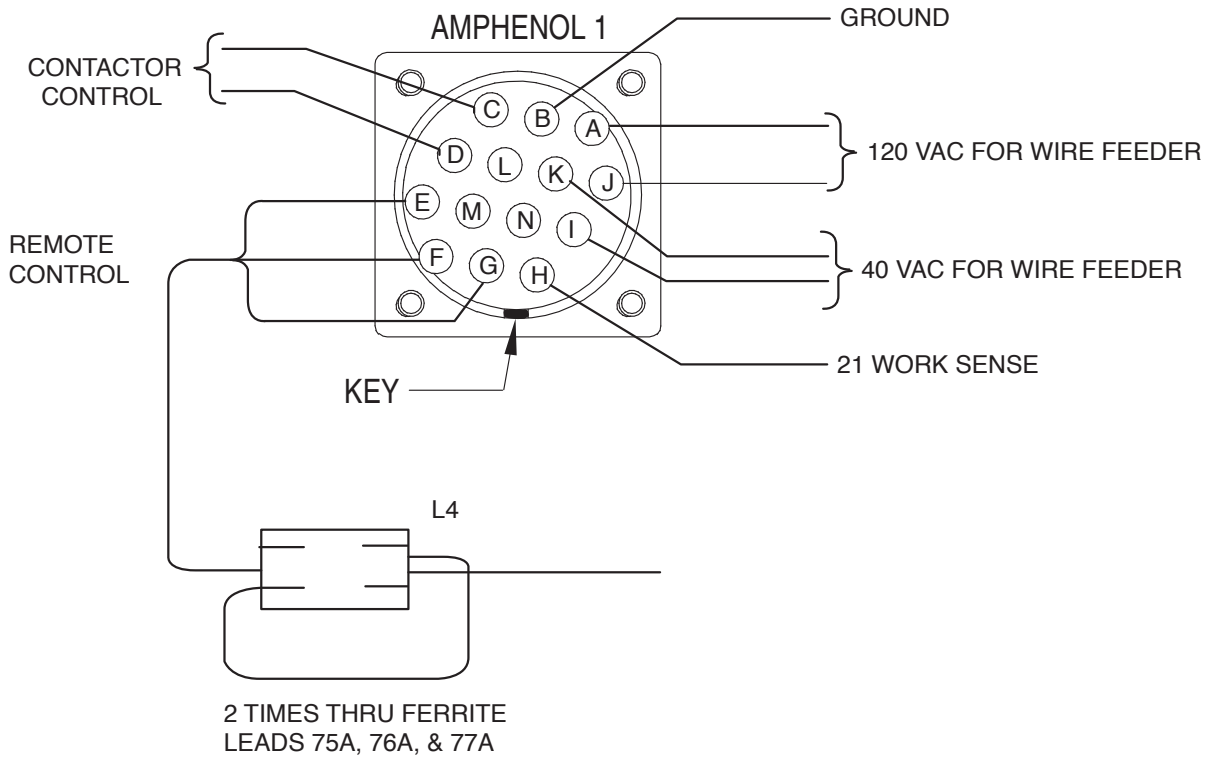
NOTE: The slip ring voltage will most likely be correct if at least one of the AC output voltages is correct.

MATERIALS NEEDED

Miscellaneous hand tools
Voltmeter
Test pins

STATOR VOLTAGE TESTS (CONTINUED)

FIGURE F.11 RECEPTACLE LEAD LOCATIONS (TYPICAL)



TEST PROCEDURE

1. Perform the ***Case Cover Removal*** procedure.

NOTE: Voltage tests of the 120 and 120/240 VAC receptacles can be performed by placing the meter probes directly into the appropriate connection slots in the front of the receptacles rather than testing at the lead connections described below. If the meter probes are not long enough to make contact with the conductors inside the receptacles, test pins may be used.

To test the 120 VAC auxiliary winding:

1. Connect the volt/ohmmeter probes to either 120 VAC receptacle as follows.
2. For the upper receptacle, place the probes directly into receptacle, or connect to leads #3D and #5A. See Figure F.11. See wiring diagram.

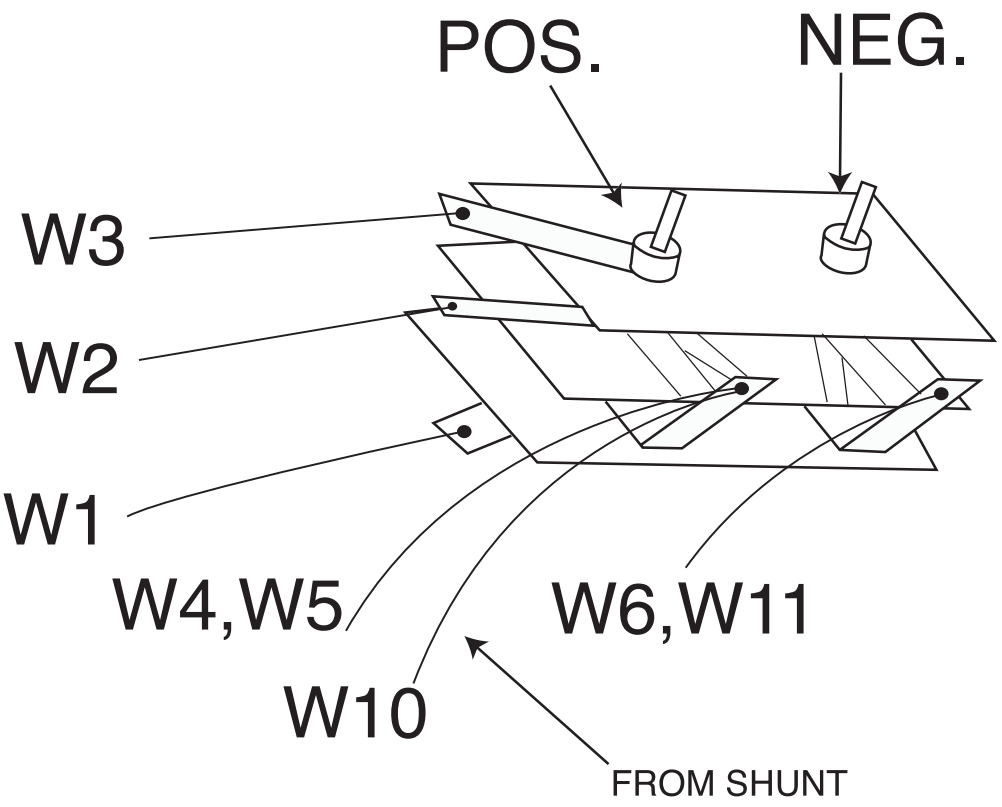
   For the lower receptacle, place the probes directly into the receptacle, or connect to leads #6E and 5B. See Figure F.11. See wiring diagram.
3. Start the engine and run it at high idle (1860-1890 RPM).
4. Check the AC voltage reading. It should read between 115 and 132 VAC.

To test the 240 VAC auxiliary winding:

1. Connect the meter probes to leads #6F and #3E where they connect to the 120/240VAC receptacle, or insert the probes into the 240 VAC connection slots in the front of the receptacle. See Figure F.11. See wiring diagram.
2. Start the engine and run it at high idle (1860-1890 RPM).
3. Check the AC voltage reading. It should read between 230 and 264 VAC.
4. If these voltage readings are not within the specified limits, check for tripped or defective circuit breakers, loose connections, or broken wires between the test points and the stator windings. If there are no wiring problems, and the circuit breakers are not tripped or defective, the stator is defective and should be replaced.

STATOR VOLTAGE TESTS (CONTINUED)

FIGURE F.12 - RECTIFIER BRIDGE DETAIL



To test the 120 VAC wire feeder supply:

NOTE: The wire feeder AC voltage supply tests require that the meter probes be inserted into the Amphenol connection cavities. Care should be taken to avoid damaging or expanding the terminals when inserting the probes.

NOTE: The 120 VAC power supplied to the 14 pin Amphenol connector originates from the same winding that supplies the 120 VAC receptacles. If the machine has previously passed 120VAC auxiliary winding test, this test can only reveal problems in connections or components between the Amphenol and the stator winding.

1. Connect the voltmeter probes to pins “A” (lead #32) and “J” (lead #31) of the 14 pin Amphenol. See figure #3 and wiring diagram.
2. Start the engine and run it at high idle (1860 to 1890 RPM).
3. The AC voltage reading should be between 115 and 132 VAC.
4. If these voltage readings are not within specifications, check for a tripped or defective circuit breaker, faulty connections, or broken wires between the test points and the stator windings. See wiring diagram.

STATOR VOLTAGE TESTS (CONTINUED)

To test the 42 VAC wire feeder winding:

1. Connect the voltmeter probes to pins “I” (lead 41A) and “K” (lead #42A) of the 14 pin Amphenol. ***See Figure F.11.***
2. Start the engine and run it at high idle (1860 to 1890 RPM).
3. The AC voltage reading should be between 40 and 50 VAC.
4. If these voltage readings are not within the specified limits, check for a tripped or defective circuit breakers, loose connections, or broken wires between the test points and the stator windings. If there are no wiring problems, and the circuit breakers are not tripped or defective, the stator is defective and should be replaced.

To test the three-phase weld winding:

1. Locate weld winding leads W1, W2, and W3 where they connect to the three-phase output bridge rectifier. ***See Figure F.12.*** See wiring diagram.
2. Start the engine and run it at high idle (1860 to 1890 RPM).
3. Check for about 60 to 65 VAC from leads W1 to W2, W2 to W3, and W1 to W3.
4. If these voltage readings are not within the specified limits, check for loose connections or broken wires between the test points and the stator windings. If there are no wiring problems, the stator is defective and should be replaced.

* These values are maximum for a cold machine.

STATOR SHORT CIRCUIT & GROUND TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if there are undesirable electrical connections between the stator windings and chassis ground, or between individual windings within the stator.

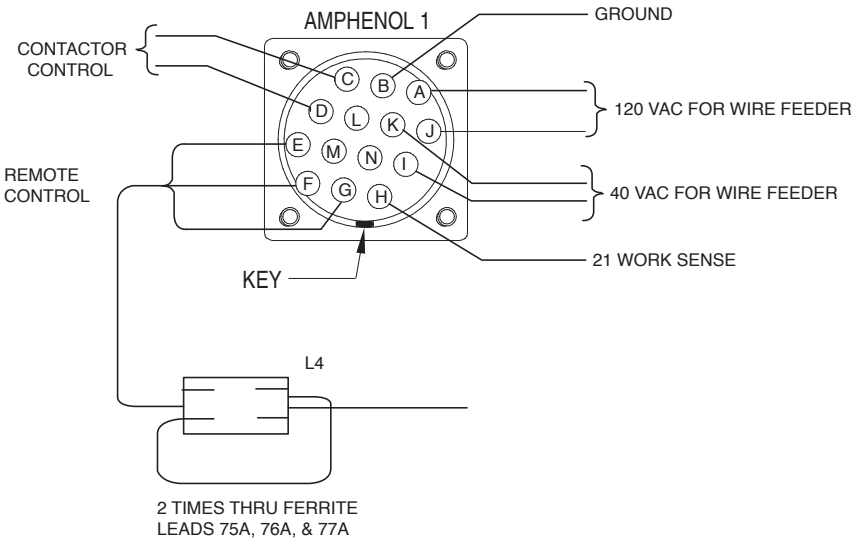
This test should be performed if flashing voltage is present at the rotor slip rings, Rotor resistance, field bridge rectifier, field capacitor and all associated wiring are proven to be good, but the stator output voltage fails to build-up to normal levels, or is too high in one or more, but not all, of the windings.

MATERIALS NEEDED

Miscellaneous hand tools
Ohm meter

STATOR SHORT CIRCUIT & GROUND TEST (CONTINUED)

FIGURE F.13 - WELD CONTROL BOARD



TEST PROCEDURE

1. Perform ***Case Cover Removal Procedure***.
2. Perform ***Capacitor Discharge Procedure***.
3. Unplug anything that may be connected to the auxiliary receptacles or the 14 pin amphenol.
4. Disconnect and isolate GND-E lead from the bottom ground screw inside the left case front. See control Inner-Connection diagram. See Figure F.13.
5. Disconnect the #5 and #6 leads from the field bridge rectifier. See Wiring Diagram.
6. Using an ohmmeter, check the resistance between chassis ground and each of the following points; Resistance should read very high, 500,000 (500K) ohms minimum.
   1) Pin 1 at the 14 pin amphenol, and the #5 lead that had been disconnected from the ground screw. (this checks for a connection between the wire feed winding and the auxiliary winding.)
   2) Pin 1 of the 14 pin amphenol and lead #7 or #9. (This checks for a connection between the wire feed winding and the exciter winding.)
   3) Pin 1 of the 14 pin amphenol an lead W1, W2, or W3. (This checks for a connection between the wire feed winding and the weld winding).
   4) Lead #5 and lead #7 or #9. (This checks for a connection between the auxiliary winding and the weld winding). See Wiring Diagram.
   5) Lead #5 and lead W1, W2, or W3. (This checks for a connection the auxiliary winding and the weld winding.) See Wiring Diagram.
   6) Lead #7 or #9 and lead W1, W2, or W3. (This checks for a connection between the exciter winding and the weld winding.) See Wiring Diagram.

If any of the above readings is less than 500,000 (500k) ohms, check for damaged, contaminated, or shorted wiring or components between the test points and the stator winding. If necessary, disconnect and isolate the stator leads as close to the stator winding as possible. See wiring diagram. If the low resistance is determined to be between the windings within the stator, the stator is defective and should be replaced*.

NOTE: The field bridge rectifier and field capacitor may appear to function normally when tested independently. But may malfunctions when placed under the stress of normal operation. For this reason, It is recommended that the bridge rectifier and capacitor be replaced with known good components before replacing the stator.

OUTPUT RECTIFIER BRIDGE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will determine if the rectifier is grounded, or if there are any failed diode groups.

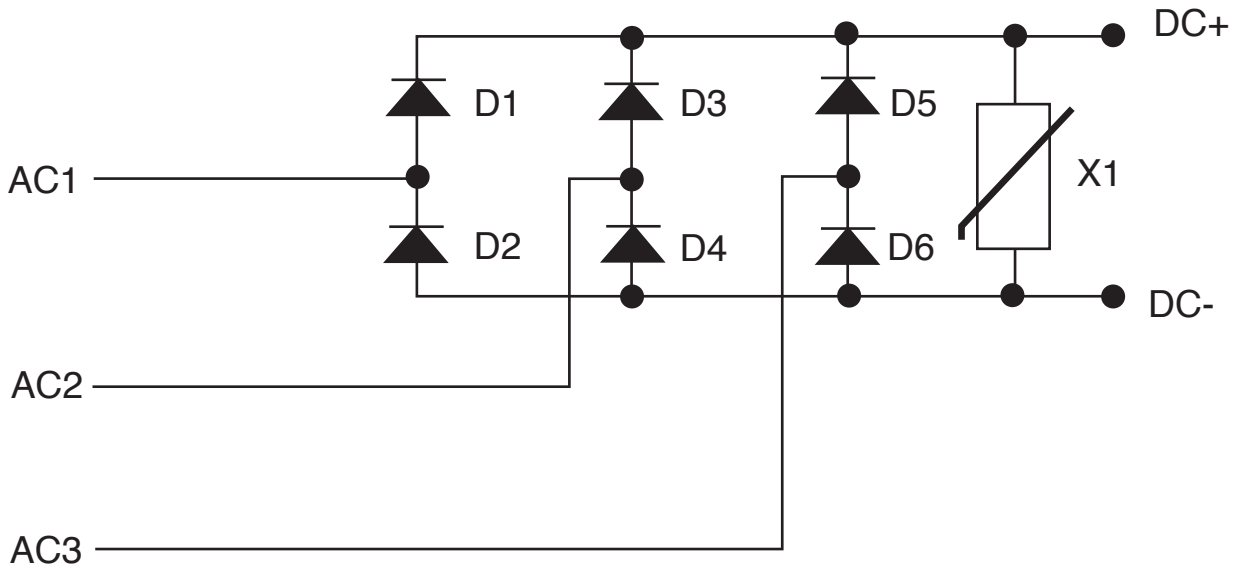
NOTE: This test will not be able to detect individual open diodes within a group.

MATERIALS NEEDED

Miscellaneous hand tools
Analog Ohmmeter or diode tester (For testing diodes)
Ohm meter (any type for ground test)

OUTPUT RECTIFIER BRIDGE TEST (CONTINUED)

FIGURE F.14



TEST PROCEDURE

1. Turn the engine off.
2. Perform the Case Cover Removal procedure.
3. Perform the Chopper Module Capacitor Discharge procedure.

   Electrically isolate the three-phase input terminals of the output bridge rectifier as follows:

4. Mark leads W1, W2, and W3 so they can be properly reconnected after the test is complete. Remove these leads and position them so they do not come in contact with any part of the rectifier. ***See Figure F.15.*** See wiring diagram.

   Electrically isolate the DC output terminals of the rectifier:

5. Mark the leads connected to the positive and negative terminals of the output bridge rectifier to assure that they can be reconnected properly. ***See Figure F.15.***
6. Remove leads W4, W5, and W10 from the positive terminal of the Rectifier, and remove leads W6 and W11 from the negative terminal. Position these leads so they do not come to contact with any part of the rectifier. ***See Figure F.15.*** See the wiring diagram..

OUTPUT RECTIFIER BRIDGE TEST (CONTINUED)

7. Check for grounds by placing one of the ohm meter probes on a clean, unpainted metal surface of the machine. Touch the other probe to each of the five rectifier terminals. The resistance to chassis ground from each terminal should be very high, 500,000 (500K) ohms minimum. If the resistance reading is less than specified, the rectifier is grounded and should be replaced.
8. If using diode checker or a multimeter with diode check functionality, read and understand the instructions that accompany your test equipment.
9. If using an analog ohmmeter, the forward bias test will indicate low resistance and the reverse bias test will indicate high resistance. Precise ohm values for this test will vary depending on the test equipment used.

NOTE: A digital Ohmmeter is not recommended for this test. A typical digital Ohmmeter does not provide enough voltage or current flow to reliably test the diodes used in this rectifier.

10. Test all of the diode groups per the ***Table F.1.***

FIGURE F.15 - SHUNT/RECTIFIER LEADS

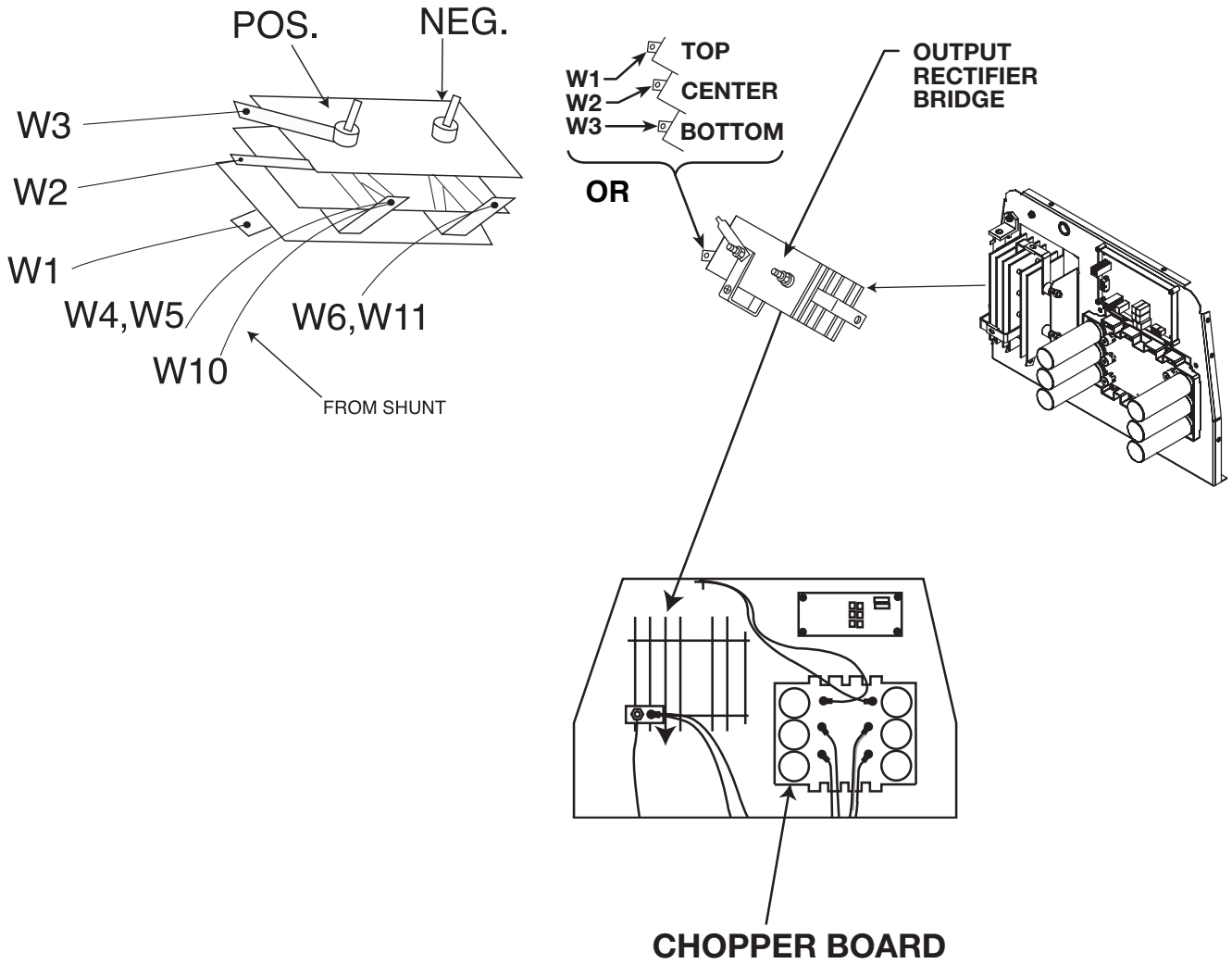


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TABLE F.1 – DIODE TEST TABLE

Rectifier Terminal Connections	Test Instrument		
	(+) Lead	(-) Lead	Diode Bias and Expected Test Result
	AC1	DC(+)	FORWARD BIAS (Low Resistance)
	AC2	DC(+)	FORWARD BIAS (Low Resistance)
	AC3	DC(+)	FORWARD BIAS (Low Resistance)
	DC(-)	AC1	FORWARD BIAS (Low Resistance)
	DC(-)	AC2	FORWARD BIAS (Low Resistance)
	DC(-)	AC3	FORWARD BIAS (Low Resistance)
	AC1	DC(-)	REVERSE BIAS (High Resistance)
	AC2	DC(-)	REVERSE BIAS (High Resistance)
	AC3	DC(-)	REVERSE BIAS (High Resistance)
	DC(+)	AC1	REVERSE BIAS (High Resistance)
	DC(+)	AC2	REVERSE BIAS (High Resistance)
	DC(+)	AC3	REVERSE BIAS (High Resistance)

11. Reconnect all leads.
12. Perform the ***Case Cover replacement Procedure***.

CHOPPER MODULE FUNCTION TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test will help determine if the chopper module is functioning properly, and receiving the correct input from the output rectifier and control PC board.

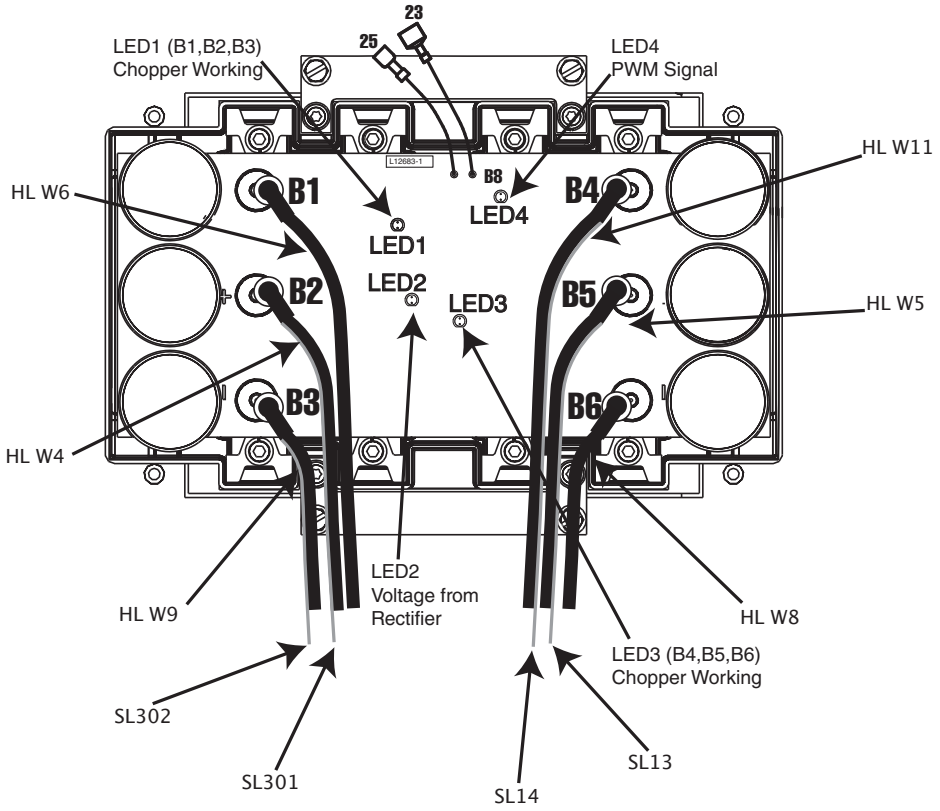
This test can only provide meaningful results if the machine is producing normal AC auxiliary output.

MATERIALS NEEDED

Miscellaneous hand tools
Digital Multi-meter
Frequency counter or digital multi-meter with frequency counter function.
Wiring diagram
Control Inner-Connection diagram

CHOPPER MODULE FUNCTION TEST (CONTINUED)

FIGURE F.16 - CHOPPER MODULE CONNECTIONS



TEST PROCEDURE

1. Perform the ***Case Cover Removal Procedure***.
2. Make sure that there is nothing plugged into either of the Amphenol receptacles.
3. Place idle switch in the “HIGH” position.
4. Place the mode switch in the “CC-STICK” position.
5. Place the Welding Terminal switch in the “REMOTELY CONTROLLED” position.
6. Start the engine and allow it to stabilize at high idle RPM.
7. Check for 80 to 100 VDC at terminals B1- to B2+ and B4- to B5+ of the chopper module. See wiring diagram and figure #1.
8. If the correct DC voltage is not present at terminals B1- to B2+ and B4- to B5+, check for damaged conductors or faulty connections between the chopper module, the output rectifier, and the stator weld winding. See Figure F.17. See the wiring diagram. Perform the ***Stator Voltage Tests***, and the ***Output Rectifier Test***.
9. If the correct voltage is present at terminals B1- to B2+ and B4- to B5+ of the chopper module, check for DC voltage at the chopper module terminals B2+ to B3-, and B5+ to B6-, If significant voltage is present, disconnect leads #23 and #25 from the chopper module PC board. If voltage is still present, the copper module is shorted and should be replaced.
10. If the voltage drops to 0 VDC after the #23 and #25 leads have been disconnected, the control PC board is driving the chopper module when it should not be doing so. Reconnect the #23 and #25 leads and perform the ***Weld Control Board Gate Drive Test***.
11. Reconnect leads #23 and #25, and place the Welding Terminal switch in the “WELD TERMINALS ON” position.
12. Check for about 58 VDC between Chopper Module Terminals B2+ to B3-, and B5+ to B6 and between the welder output terminals. See Figure F.16. See the wiring diagram.

CHOPPER MODULE FUNCTION TEST (CONTINUED)

TEST PROCEDURE (CONTINUED)

13. If about 58 VDC is present at chopper module terminals B2+ to B3-, and B5+ to B6-, but not at the output terminals, there is a problem between the chopper module and one of the output terminals. Check for damaged conductors or faulty connections, on leads W7, W8, W9, and W10. Also check the shunt, the choke, and the connections at the back of the output terminals. See the wiring diagram.
14. If the voltage at terminals B2+ to B3-, and B5+ to B6- of the Chopper module is significantly higher than 58 VDC, check for an open R4 load resistor. See the Control Inner-Connection diagram. Also check for damaged conductors or faulty connections at leads #302 and #302. See wiring diagram.
15. If the voltage at terminals B2+ to B3-, and B5+ to B6- of the chopper module is very low, or not present, use the frequency counter to check for the presents of a 20 kHZ PWM signal between leads #23 +and #25-, where they connect to the chopper module PC board.
16. If the 20 kHz signal is present, the chopper module is defective. Replace.
17. If the 20 kHz signal is not present, perform the ***Weld Control Board PWM Gate Signal Test***.
18. If the weld control board is producing a PWM gate signal, check th e#23 and #25 leads for damaged conductors and faulty connections between the control PC board and the chopper module.
19. If testing is complete, Perform the ***Case Cover Replacement*** procedure.

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CHOPPER MODULE RESISTANCE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

This test will help determine if the chopper module is shorted. This test can only detect some problems in the “Power” section of the module. Problems in some other PC board components may not be detected.

MATERIALS NEEDED

Miscellaneous hand tools
Digital Ohmmeter
Wiring diagram

CHOPPER MODULE RESISTANCE TEST (CONTINUED)

TEST PROCEDURE

1. Perform the ***Case Cover Removal Procedure***.
2. Perform the ***Capacitor Discharge Procedure***.
3. Check that all of the leads connected to the chopper module terminals are clearly marked to facilitate reassembly. Remove all of the leads from the chopper module and position them so they do not make electrical contact with any part of the module. See the wiring diagram.
4. Use a digital Ohmmeter to test the module per ***Table F.2***.

CHOPPER MODULE RESISTANCE TEST (CONTINUED)

FIGURE F.2 - DIODE TEST TABLE

Chopper Terminal Connections	OHMMETER		OHMMETER READING
	(+) Lead	(-) Lead	Diode Bias and Expected Test Result
	B5	B6	6K to 9K
	B6	B5	6K to 9K
	B4	B5	200k or higher
	B5	B4	400k or higher
	B4	B6	200k or higher
	B6	B4	400k or higher
	B2	B3	6K to 9K
	B3	B2	6K to 9K
	B4	B2	200k or higher
	B2	B4	400k or higher
	B4	B3	200k or higher
	B3	B4	400k or higher

5. Reconnect all leads.
6. The chopper module screw connection should be lightened to 50-60 inch-pounds.
7. Perform the ***Case Cover Replacement procedure***.

Return to Section TOC
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WELD CONTROL BOARD PWM GATE SIGNAL TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test will determine if the weld control PC board is able to produce the PWM (Pulse Width Modulated) gate signal needed to control the IGBTs (Insulated Gate Bipolar Transistor) on the chopper module. This test will also verify that the control PC board can turn the PWM gate signal on and off properly.

MATERIALS NEEDED

Digital Multi-meter
Frequency counter, or digital Multi-meter with frequency counter function
Wiring Diagram
Control Inner-Connection diagram

WELD CONTROL BOARD PWM GATE SIGNAL TEST (CONTINUED)

TEST PROCEDURE

1. Perform the ***Case Cover Removal Procedure***.
2. Unplug any device that may be attached to either the 6 pin or the 14 pin Amphenol receptacles.
3. Place the idle switch in the “HIGH IDLE” position.
4. Place the mode switch in the “CC-STICK” position.
5. Place the Weld terminals switch in the “WELD TERMINALS ON” position.
6. Start the engine and let it run and stabilize at high idle RPM.
7. Locate plug P3 on the control PC board. See Control Inner-Connection diagram.
8. Use the frequency counter to test for 20kHz PWM gate signal between leads #23+ (P3-10) and #25- (P3-9).
9. If the 20KHz gate signal is present, place the weld terminals switch in the ”REMOTELY CONTROLLED” position. The gate signal should turn off.
10. If the 20 KHz gate signal responds as described above, this test is complete.
11. If there is no 20 KHz gate signal, test for the presents of 80 to 100 VDC, at leads 13+ (P3-8) to 14- (P3-16) of the weld control PC board.
12. If voltage is very low or not present, check leads #13 and #14 for faulty or damaged wiring or connections between the control PC board and the chopper module.
13. Test for 80 to 100 VDC at the terminals where the #13 and #14 leads connect to the chopper module. See the wiring diagram. If there is no voltage at the chopper module, perform the chopper module function test.
14. If the 80 to 100 VDC supply voltage is present at the weld control PC board, but there is no PWM gate signal, check the voltage between leads #2+ (P1-4) and #4 (P1-3). See figure #1

    The voltage should be about 0 VDC.
15. If about 5 VDC is detected, the welding terminal control circuit is open. Check for damaged leads for faulty connections at leads #2 and #4; also check for a defective welding terminal switch. See the wiring diagram.
16. If the PWM signal remains after the welding terminal switch has been placed in the “REMOTELY CONTROLLED” position, check the voltage between leads #2+ (P1-4) and #4- (P1-3) at the control PC board.
17. If the voltage reads 0 or very near 0, Check for damaged insulation at leads #2 and #4, also check for a shorted welding terminal switch, or damaged or contaminated Amphenol receptacle. See the wiring diagram.
18. If the above wiring and components are undamaged and functioning properly, the control PC board is defective and should be replaced.
19. If the voltage reads about 5 VDC, and the PWM signal remains, the control PC board is defective and should be replaced.
20. Perform the ***Case Cover Replacement Procedure***.

WELD CONTROL FEEDBACK TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test will determine if the weld control PC board is receiving accurate current and voltage feedback from the weld circuit.

This test will only yield usable information if the machine is producing some weld output.

MATERIALS NEEDED

Digital Multi-meter suitable for accurate readings in both the millivolt and normal weld voltage ranges.
Resistive load bank
Ammeter, suitable for accurate readings of normal welding current. (Often built into the load bank.
Wiring diagram
Control Inner-Connection diagram

WELD CONTROL FEEDBACK TEST (CONTINUED)

TEST PROCEDURE

1. Place the idle switch in the “HIGH IDLE” position.
2. Place the mode switch in the “CC-STICK” position.
3. Place the weld terminals switch in the “WELD TERMINALS ON” position.
4. Make sure that nothing is plugged into either Amphenol receptacle.
5. Connect the resistive load bank and the ammeter to the weld output terminals per the equipment manufacturer’s instructions; also connect the voltmeter probes across the weld output terminals.
6. Start the machine and, apply a load of about 200 Amps, as shown on the external ammeter. If the machine will not produce 200 amps, apply as much load as you can.
7. Compare the readings shown on the external ammeter and voltmeter to the amps and volts displayed on the front panel of the machine.
8. If the readings shown on the front panel displays are about the same or very close to the reading on the external meters, the feedback is probably good, and this test is complete.
9. If the readings differ significantly, continue with this procedure
10. Turn off the engine and release the load from the weld terminals. (The load bank and ammeter should remain connected, but the load should be released.)
11. Perform the ***Case Cover Removal Procedure***.
12. Locate plugs P3 and P6 on the control PC board. See figure #1. Remove the plugs and check for dirt, corrosion, damaged, expanded, or incorrectly positioned terminals. Repair or replace wiring components as needed and reconnect the plugs to the control board.
13. Restart the machine and apply a load across the weld terminals that measures about 200 amps. If the machine will not produce 200 amps of current, apply as much load as you can.
14. Using the voltmeter, measure and note the DC voltage at the weld output terminals.
15. Check the voltage between leads #204S+ (P6-1) and lead #208B- (P3-15) at the control PC board Molex plugs. The voltage should be the same as was measured at the weld terminals.

WELD CONTROL FEEDBACK TEST (CONTINUED)

16. If the voltage readings are different, check the wiring and connections between the welding terminals and the control PC board. See the wiring diagram.

17. Connect the millivolt meter probes between lead #206S+ (P6-2) and lead 204S- (P6-1). See Wiring Diagram. If the machine is currently producing 200 amps the millivolt meter should read about 25 millivolts.

18. If the machine cannot produce 200 amps of weld current, the correct millivolt signal will need to be calculated by dividing the reading displayed on the external ammeter by 8. See the following explanation.

19. The shunt used in this machine will produce 50 millivolts at a load of 400 amps, or 8 amps per millivolt.

20. To calculate the correct millivolt signal for a given load, you divide the number of amps displayed on the ammeter by 8.

    Example: If your ammeter reads 75, (75/8 = 9.4) If the shunt is working correctly, and the wiring between the shunt and the control PC board is in good condition, the meter connected at the control PC board should be reading about 9.4 millivolts.

21. If the millivolt reading is incorrect, check the wiring between the shunt and the control PC board for damage, grounds, and faulty connections. If the wiring is good, the shunt and lead assembly is faulty and should be replaced.

22. Perform the ***Case Cover Replacement Procedure***.

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CONTROL POTENTIOMETER AND MODE SWITCH RESISTANCE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test will check the Output Control potentiometer, Arc Control potentiometer, Mode Switch, and associated wiring for damage, proper operation, tracking, and grounds.

MATERIALS NEEDED

Digital Ohmmeter
Wiring Diagram
Control Inner-Connection Diagram

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CONTROL POTENTIOMETER AND MODE SWITCH RESISTANCE TEST (CONTINUED)

TEST PROCEDURE

1. Turn the engine off
2. Perform the Case cover Removal Procedure.
3. Unplug P7 from control board, see control Inner-connection diagram, and visually check the plug and attached wiring for damage, corrosion, improperly seated or damaged contact pins. P7 will remain unplugged for following test.
4. Set the mode switch in the “CC-Stick” position.
5. Test the resistance between each of the leads in P7 and a good clean chassis ground connection. Be very careful that the connection pins in P7 are not damaged or spread out.
6. The resistance should be very high. A reading of 500,000 (500k) ohms or higher is acceptable.
7. If the resistance is lower than 500k Ohms, replace the potentiometer and mode switch plug and lead assembly, or replace the defective component within the assembly. See wiring diagram.
8. Perform the resistance tests per ***Table F.3.***
9. If the resistance readings are not as specified in the table, replace the potentiometer and mode switch plug and lead assembly, or replace the defective component. See the wiring diagram.
10. If testing is complete, plug P7 back into the control PC board and perform the ***Case Cover Replacement procedure***.

CONTROL POTENTIOMETER AND MODE RESISTANCE TEST (CONTINUED)

TABLE F.3

POT/MODE SWITCH RESISTANCE TEST		
MODE SWITCH SETTING	**OHMMETER CONNECTION**	
CC-STICK	P7-9 (#214) TO P7-14 (#218)	500K or Higher
CC-STICK	P7-9 (#214) TO P7-15 (#220)	500K or Higher
CC-STICK	P7-9 (#214) TO P7-16 (#222)	500K or Higher
CC-STICK	P7-14 (#218) TO P7-15 (#220)	500K or Higher
CC-STICK	P7-14 (#218) TO P7-16 (#222)	500K or Higher
CC-STICK	P7-15 (#220) TO P7-16 (#222)	500K or Higher
TOUCH START TIG	P7-15 (#220) TO P7-16 (#222)	*
DOWNHILL PIPE	P7-14 (#218) TO P7-16 (#222)	*
CV-WIRE	P7-9 (#214) TO P7-16 (#222)	*
N/A	P7-5 (#75) TO P7-1 (#77)	about 10K
N/A	P7-1 (#77) TO P7-4 (#76)	Ohms values should sweep smoothly from 10K to 0 when ARC CONTROL is turned from Min. to Max.
N/A	P7-6 (#279) TO P7-8 (#277)	about 10K
N/A	P7-8 (#277) TO P7-7 (#278)	Ohms values should sweep smoothly from 10K to 0 when ARC CONTROL is turned from Min. to Max.

* Resistance should be very low, The Ohmmeter should read about the same value as one would get by touching the two meter probes together.

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REMOTE RECEPTACLE RESISTANCE TEST

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This test will help determine if there is a problem with the remote receptacle control wiring, relating to electrical tracking between other control conductors, power conductors, or ground. This test also checks the function of the weld terminal switch.

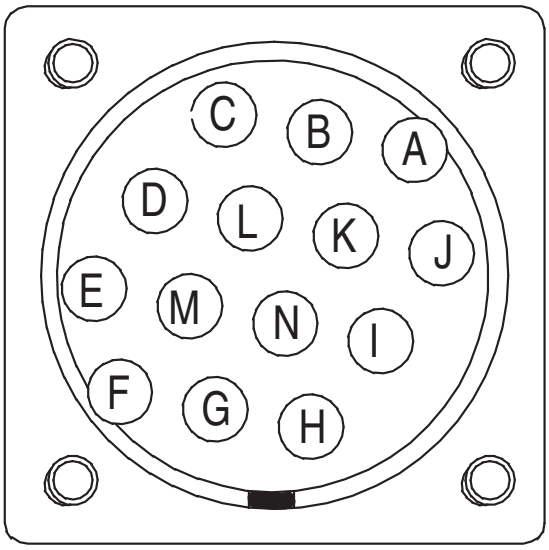
MATERIALS NEEDED

Ohm Meter
Wiring Diagram
Control Inner-Connection diagram

REMOTE RECEPTACLE RESISTANCE TEST (CONTINUED)

FIGURE F.17

AMPHENOL 1



TEST PROCEDURE

1. Turn the machine off.
2. Perform the ***Case Cover Removal Procedure.***
3. Make sure that there are no devices of any kind plugged into either Amphenol receptacles.
4. Remove Molex plug P1 from the control PC board, see Control Inner-Connection Diagram. Examine the Molex plug and the receptacle on the control PC board for dirt, corrosion, damaged or out-of-position pins. Repair or replace any damaged components. Position the P1 plug so it can not make electrical contact with any other conductor or chassis ground.
5. Perform the following resistance tests shown in the following table. Be very careful not to damage or spread any of the connection pins in the Amphenol receptacle. ***See Table F.4.***
6. If the measured resistance does not meet values specified, check for damage, dirt or moisture contamination in the Amphenol receptacles and the P1 Molex plug. Check for damaged or grounded wiring.
7. If the resistance values are found to be too low, due to contaminated electrical components in the Amphenol harness assembly. Try removing the contamination and drying the components completely. If the resistance values are still too low, replace the Amphenol harness assembly.
8. If the values are incorrect for the last two tests in the table, (Pin C to Pin D) check the welding terminal switch and the wiring connected to that switch. See the wiring diagram. Repair any faulty connections or replace the switch if necessary.
9. Plug P1 back into the Control Pc board.
10. Perform the ***Case Cover Replacement Procedure***.

REMOTE RECEPTACLE RESISTANCE TEST *(continued)*

TABLE - F.4

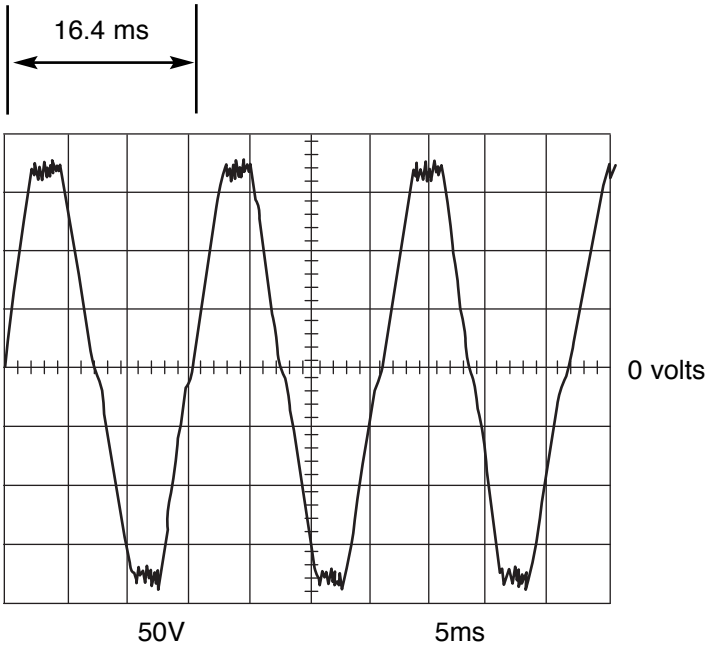
AMPHENOL RESISTANCE TEST

WELDING TERMINAL SWITCH SETTING	OHMMETER CONNECTION	OHMMETER READING
N/A	PIN “G” (#75B) to PIN “Å” (#32)	500K or Higher
N/A	PIN “G” (#75B) to PIN “B” (GND-A)	500K or Higher
N/A	PIN “G” (#75B) to PIN “C” (#2B)	500K or Higher
N/A	PIN “G” (#75B) to PIN “D” (#4B)	500K or Higher
N/A	PIN “G” (#75B) to PIN “E” (#77B)	500K or Higher
N/A	PIN “G” (#75B) to PIN “F” (#76B)	500K or Higher
N/A	PIN “G” (#75B) to PIN “H” (#21)	500K or Higher
N/A	PIN “G” (#75B) to PIN “I” (#41A)	500K or Higher
N/A	PIN “G” (#75B) to PIN “J” (#31)	500K or Higher
N/A	PIN “G” (#75B) to PIN “K” (#42A)	500K or Higher
N/A	PIN “F” (#76B) to PIN “A” (#42)	500K or Higher
N/A	PIN “F” (#76B) to PIN “B” (GND-A)	500K or Higher
N/A	PIN “F” (#76B) to PIN “C” (#2B)	500K or Higher
N/A	PIN “F” (#76B) to PIN “D” (#4B)	500K or Higher
N/A	PIN “F” (#76B) to PIN “E” (#77B)	500K or Higher
N/A	PIN “F” (#76B) to PIN “H” (21)	500K or Higher
N/A	PIN “F” (#76B) to PIN “I” (#41A)	500K or Higher
N/A	PIN “F” (#76B) to PIN “J” (#31)	500K or Higher
N/A	PIN “F” (#76B) to PIN “K” (#42A)	500K or Higher
N/A	PIN “E” (#77B) to PIN “A” (#32)	500K or Higher
N/A	PIN “E” (#77B) to PIN “B” (GND-2)	500K or Higher
N/A	PIN “E” (#77B) to PIN “C” (#2B)	500K or Higher
N/A	PIN “E” (#77B) to PIN “D” (#4B)	500K or Higher
N/A	PIN “E” (#77B) to PIN “H” (#21)	500K or Higher
N/A	PIN “E” (#77B) to PIN “I” (#41A)	500K or Higher
N/A	PIN “E” (#77B) to PIN “J” (#31)	500K or Higher
N/A	PIN “E” (#77B) to PIN “K” (42A)	500K or Higher
REMOTELY CONTROLLED	PIN “C” (#2B) to PIN “D” (#4B)	500K or Higher
WELD TERMINALS ON	PIN “C” (#2B) to PIN “D” (#4B)	*

*Resistance should be very low, The Ohmmeter should read about the same value as one would get by touching the two meter probes together.

NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY)

HIGH IDLE – NO LOAD



This is the typical auxiliary output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes are connected at machine 120 VAC receptacle.

SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

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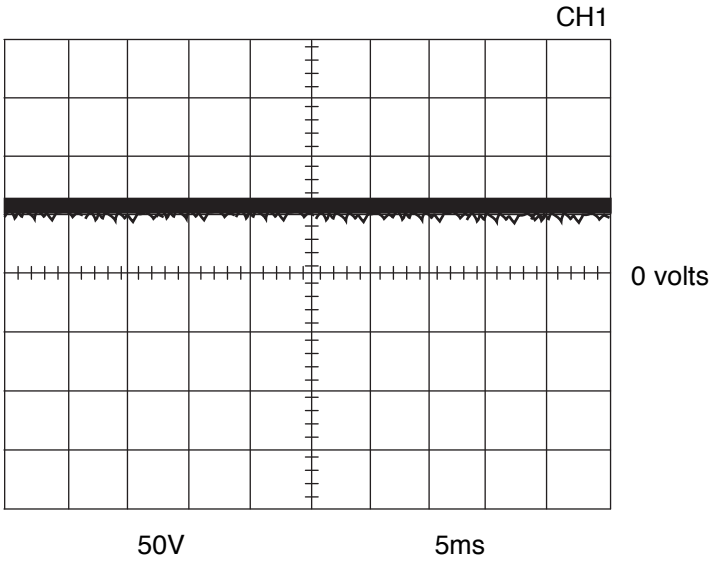
NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY)

MAX CONTROL POT - HIGH IDLE - NO LOAD



This is the typical DC open circuit output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes are connected at weld output terminals.

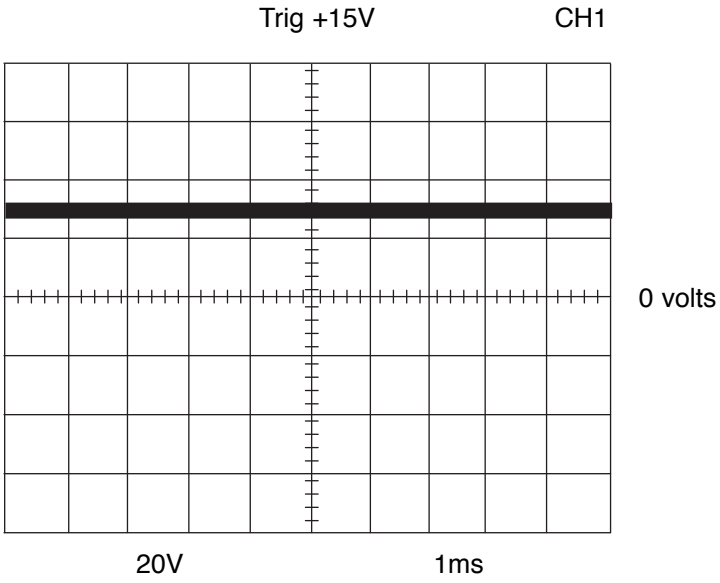
SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

Return to Section TOC
Return to Master TOC

NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (115VAC SUPPLY)

MACHINE LOADED TO 300 AMPS AT 27 VOLTS



This is the typical DC output voltage generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 1 millisecond in time.

The machine was loaded with a resistance grid bank to 300 amps at 27 volts.

NOTE: Scope probes are connected at weld output terminals.

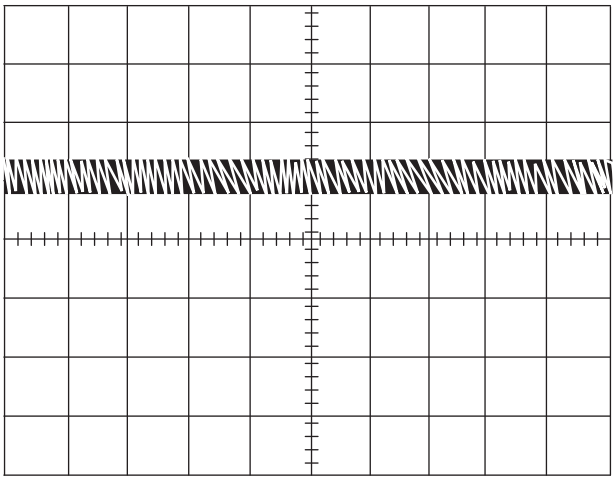
SCOPE SETTINGS

Volts/Div	20V/Div
Horizontal Sweep	1 ms/Div.
Coupling	DC
Trigger	Internal

Return to Section TOC
Return to Master TOC

NORMAL OPEN CIRCUIT VOLTAGE WAVEFORM (WIRE CV TAP)

MAX CONTROL POT - HIGH IDLE - NO LOAD



This is the typical DC open circuit output voltage generated from a properly operating machine. Note that each vertical division represents 50 volts and that each horizontal division represents 5 milliseconds in time.

NOTE: Scope probes are connected at weld output terminals.

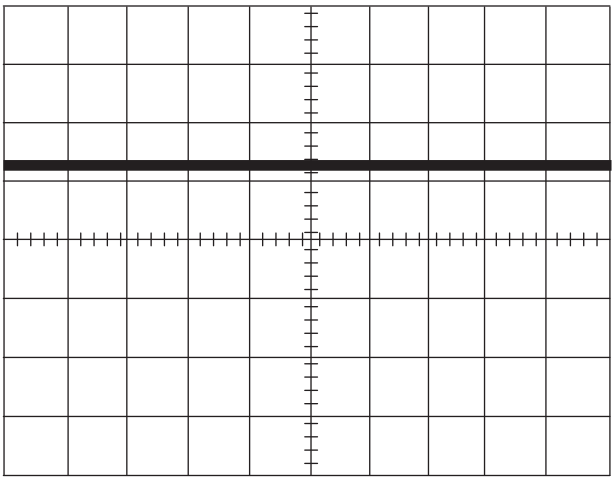
SCOPE SETTINGS

Volts/Div	50V/Div.
Horizontal Sweep	5 ms/Div.
Coupling	DC
Trigger	Internal

Return to Section TOC
Return to Master TOC

NORMAL CIRCUIT VOLTAGE WAVEFORM (WIRE CV)

MACHINE LOADED TO 300 AMPS AT 28 VOLTS



This is the typical DC voltage generated from a properly operating machine. Note that each vertical division represents 20 volts and that each horizontal division represents 1 millisecond in time.

The machine was loaded with a resistance grid bank to 300 amps at 28 volts.

NOTE: Scope probes are connected at weld output terminals.

SCOPE SETTINGS

Volts/Div	20V/Div.
Horizontal Sweep	1 ms/Div.
Coupling	DC
Trigger	Internal

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OUTPUT RECTIFIER BRIDGE AND CHOKE REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

The following procedure will aid the technician in removing and replacing the output rectifier bridge and the choke in the Vantage® 400.

MATERIALS NEEDED

Miscellaneous hand tools
Electrical joint compound (Dow Corning)

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OUTPUT RECTIFIER BRIDGE AND CHOKE REMOVAL AND REPLACEMENT (CONTINUED)

REMOVAL PROCEDURE

1. Turn the engine off.
2. Remove negative battery cable.
3. Perform the ***Case Cover Removal procedure***.
4. Perform the ***Chopper Module Capacitor Discharge procedure***.
5. Remove the four screws holding the case front to the base of the machine.
6. Remove all plugs and leads from the weld control and pull coil PC boards. Be sure to mark the leads and plugs so they can be properly re-connected. See wiring diagram.
7. Remove the screws holding the D4 diode bridge and the CR1 engine protection relay to the center baffle assembly, and allow these components to remain attached to the case front wiring.
8. Remove any additional wring and cable ties as needed. Carefully mark leads for accurate re-connection.
9. Swing the case front to the side to permit access to the Output Rectifier and Choke.

Removing the Output Rectifier

10. Remove the heavy leads from the output rectifier. Carefully mark the leads for accurate re-connection, and also note the order and position of multiple lead connections.
11. Remove the nuts and lock washers holding the Output Rectifier to the mounting bracket. You will need to reach through the large access holes on either side of the rectifier to reach these nuts.
12. Remove the Output Rectifier from the machine.

Removing the Output Choke

1. Remove the heavy leads from the choke. Carefully mark the leads for accurate re-connection, and also note the order and position of the leads in multiple lead connections.
2. Remove the three long bolts, lock washers and nuts holding the choke the mounting bracket in the machine base. Note that there is no bolt in the lower right corner of the choke.
3. Carefully remove the choke.

REPLACEMENT PROCEDURE

Replacing the Output Choke

1. Place the choke into the machine so that the three mounting holes in the choke line up with the holes in the mounting bracket.
2. Insert the three long bolts through the choke and the mounting bracket. Place a lock washer and nut on the end of each bolt and tighten.
3. Reconnect the choke leads. Position the leads, bolts, washers, and nuts exactly as they had been originally connected. Tighten the connection securely.

OUTPUT RECTIFIER BRIDGE AND CHOKE REMOVAL AND REPLACEMENT (CONTINUED)

Replacing the Output Rectifier

1. Place the Output Rectifier into the machine so that its mounting studs fit into the holes in the bracket. Place a lock washer and a nut on each stud and tighten.

2. Apply a thin film of electrical joint compound, (Dow Corning) between the surfaces of the "W" leads and the Output Rectifier. Reconnect the Output Rectifier, positioning the leads, bolts, washers, and nuts exactly as hey had been originally connected. Tighten all of the connections securely. See Wiring Diagram.

3. Swing the case front back into position.

4. Attach the case front to the machine base with four screws.

5. Reconnect all of the leads and plugs that were disconnected during the removal procedure, and replace any cable ties that were removed.

6. Perform the ***Case Cover Removal Procedure***.

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CHOPPER MODULE REMOVAL AND REPLACEMENT

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

DESCRIPTION

This procedure will aid the technician in the removal and replacement of the Chopper Module Assembly.

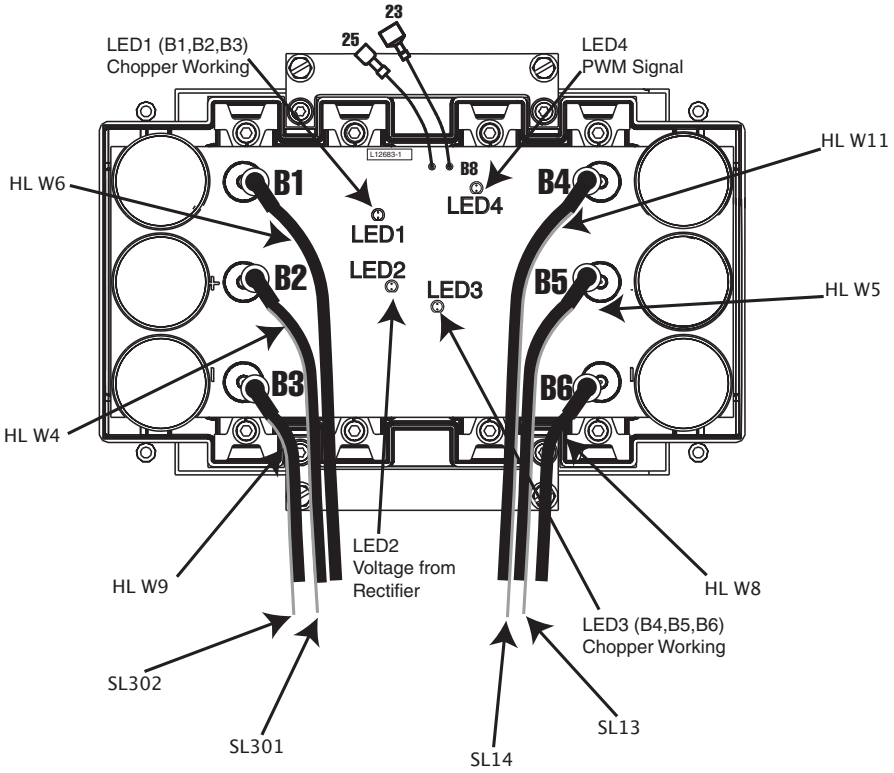
Note: The Chopper Module assembly is removed and replaced as a unit. It contains no serviceable parts.

MATERIALS NEEDED

Miscellaneous hand tools
Electrical thermal joint compound - Dow Corning

CHOPPER MODULE REMOVAL AND REPLACEMENT (CONTINUED)

FIGURE F.18 - MODULE LEAD LOCATIONS



PROCEDURE

REMOVAL

1. Turn the engine off.

2. Perform the ***Case Cover Removal Procedure***.

3. Perform the ***Chopper Module Capacitor Discharge procedure***.

4. Disconnect leads 23 and 25 at their in-line couplings.

5. Using the 7/16” socket wrench, remove the following leads. Label the leads before removal. Cut cable ties as needed. Note placement of leads and fasteners: screw, lock washer, flat washer, small lead, heavy lead.

6. Using a 3/8” socket wrench, remove the three screws holding the power module assembly to its brackets on the vertical baffle. Remove the plastic strip with the top two screws. Be sure to support the Power Module as you remove the last screw.

7. Remove the Power Module assembly from the machine.

TERMINAL	LEADS
B4	Heavy lead W11, Small lead 14
B5	Heavy lead W5, Small lead 13
B6	Heavy lead W8
B1	Heavy lead W6
B2	Heavy lead W4, Small lead 301
B3	Heavy lead W9, Small lead 302

CHOPPER MODULE REMOVAL AND REPLACEMENT (CONTINUED)

REPLACEMENT

1. Mount the heat sink to the brackets on the vertical baffle with the three 3/8” screws. Mount the plastic strip with the top two screws.

2. Connect leads 23 and 25 at their in-line couplers.

3. Using a 7/16” wrench, attach the heavy leads and small leads as follows. Note placement of leads and fasteners: screw, lock washer, flat washer, small lead, heavy lead. Apply a thin coating of electrical thermal joint compound (Dow Corning) to the mating surfaces (but not the threads). Tighten the fasteners to between 50-60 in-lbs.

4. Replace any cable ties cut at disassembly.

5. When procedures are complete, perform the ***Case Cover Replacement*** procedure.

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Return to Master TOC
Return to Section TOC
Return to Master TOC

STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE

⚠ WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact the Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed. Call 1-888-935-3877.

TEST DESCRIPTION

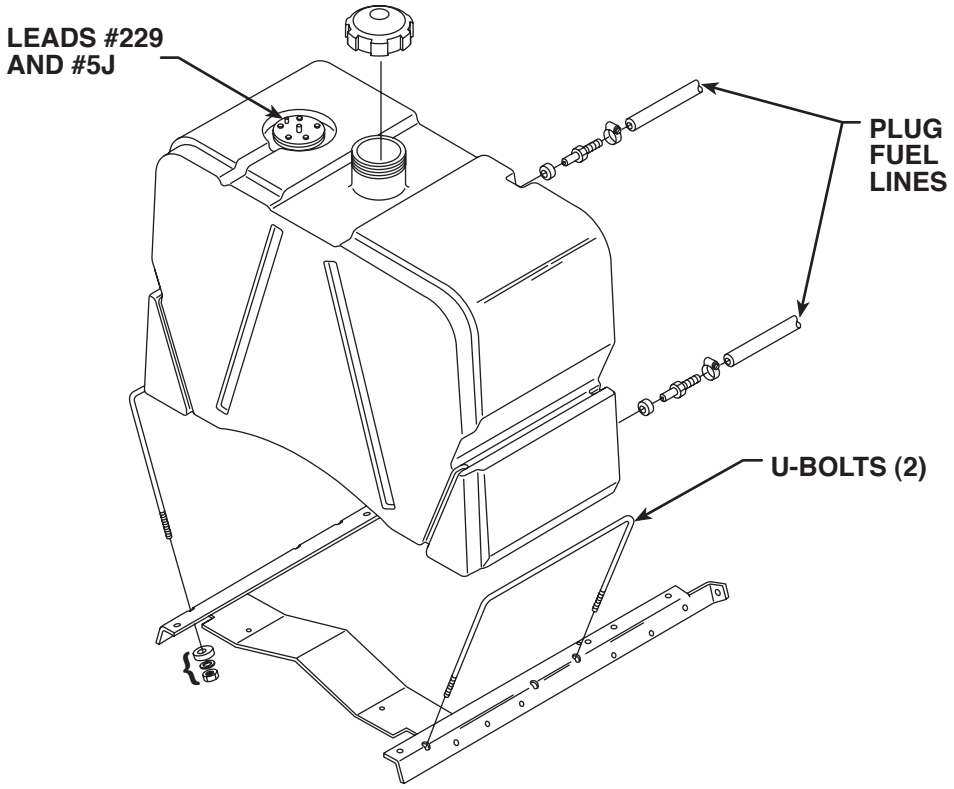
This procedure will aid the technician in the removal and replacement of the Rotor and Stator.

MATERIALS NEEDED

Misc Hand Tools

STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.19 – FUEL TANK REMOVAL



PROCEDURE

1. Turn the engine off.
2. Perform the ***Case Cover Removal Procedure,*** including the output panel.
3. Perform the ***Output Rectifier Bridge and Choke Removal Procedure.***
4. Using a 3/8” wrench, remove leads #229 (white) and #5J from the fuel level sensor. See Figure F.19. Label the leads for reassembly.
5. Turn the fuel off at the shutoff valve. Remove and plug the fuel return line. See Figure F.19.
6. Remove and plug the lower fuel line. Pull it through the firewall. See Figure F.19.
7. Using a 9/16” socket wrench, remove the four lock nuts, washers, and rubber washers from the fuel tank mounting U-bolts. See Figure F.19.
8. Carefully remove the U-bolts and lift the fuel tank from the machine.

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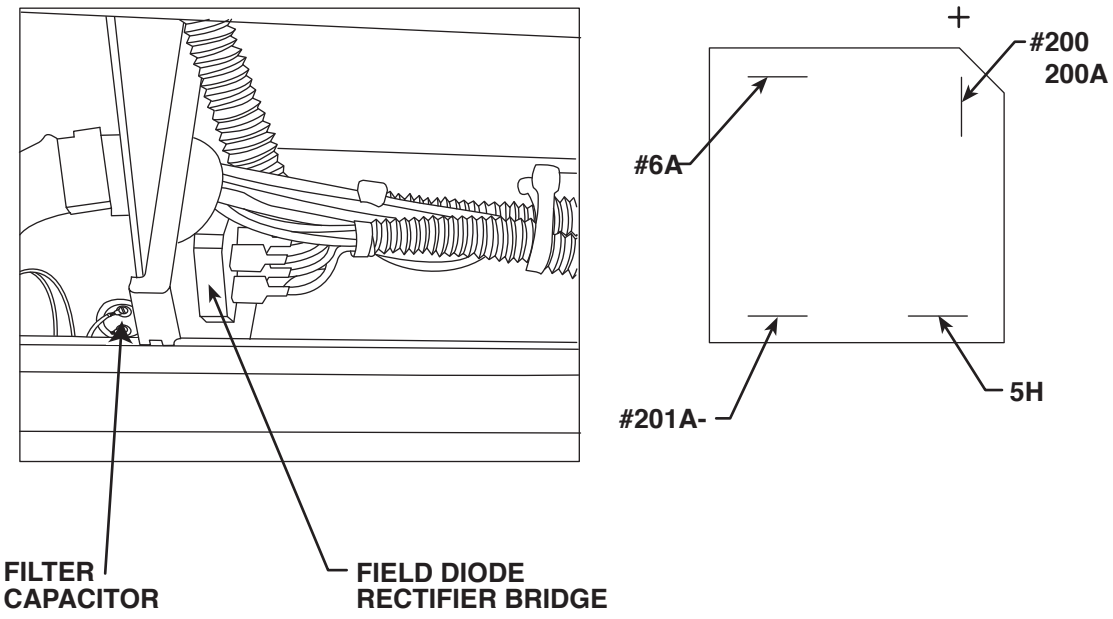
STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.20 – DOOR REMOVAL



PROCEDURE

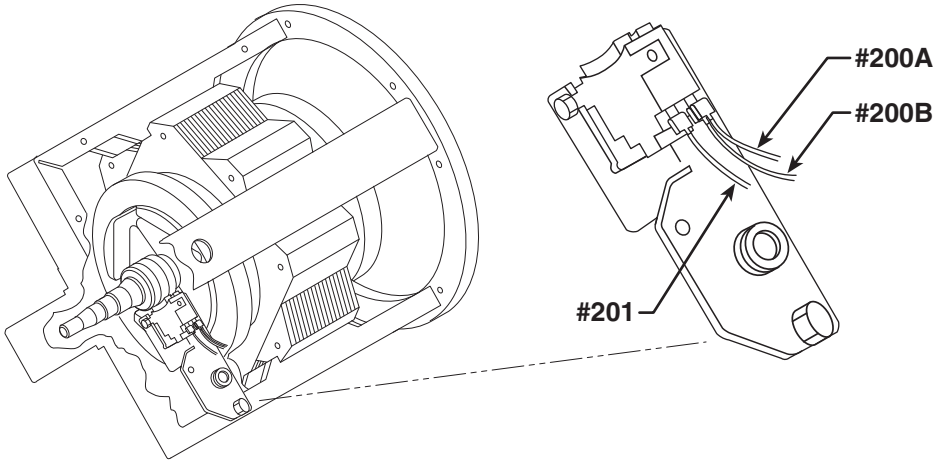
9. Disconnect plug J30 at the right front side. See Figure F.20.

10. Using the slot head screw driver, disconnect leads #200B, #200A(+) and #201A(-) from the filter capacitor. Label the leads.

11. Label and remove leads 5H, 200, 200A, 6A, 201A, 5H from the field bridge rectifier. See Figure F.20.

STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.21 – BRUSHHOLDER LEAD REMOVAL



PROCEDURE

12. Label and remove brush leads #201(-) and #200B(+) from the brush holder assembly. (The Piggy-backed leads connect closest to the stator terminations.) See Figure F.21.

13. Pull the harness containing plug J30, the brush leads, and the field bridge rectifier through the bushing in the firewall. ***See Figure F.20.***

14. Using a 3/8” wrench, remove the brush holder assembly.

15. Using the 1/2” wrench, disconnect leads #68A and #69A at their bolted connections beneath the power module assembly. Label the leads for reassembly. Cut any necessary cable ties. See ***Figure F.22.***

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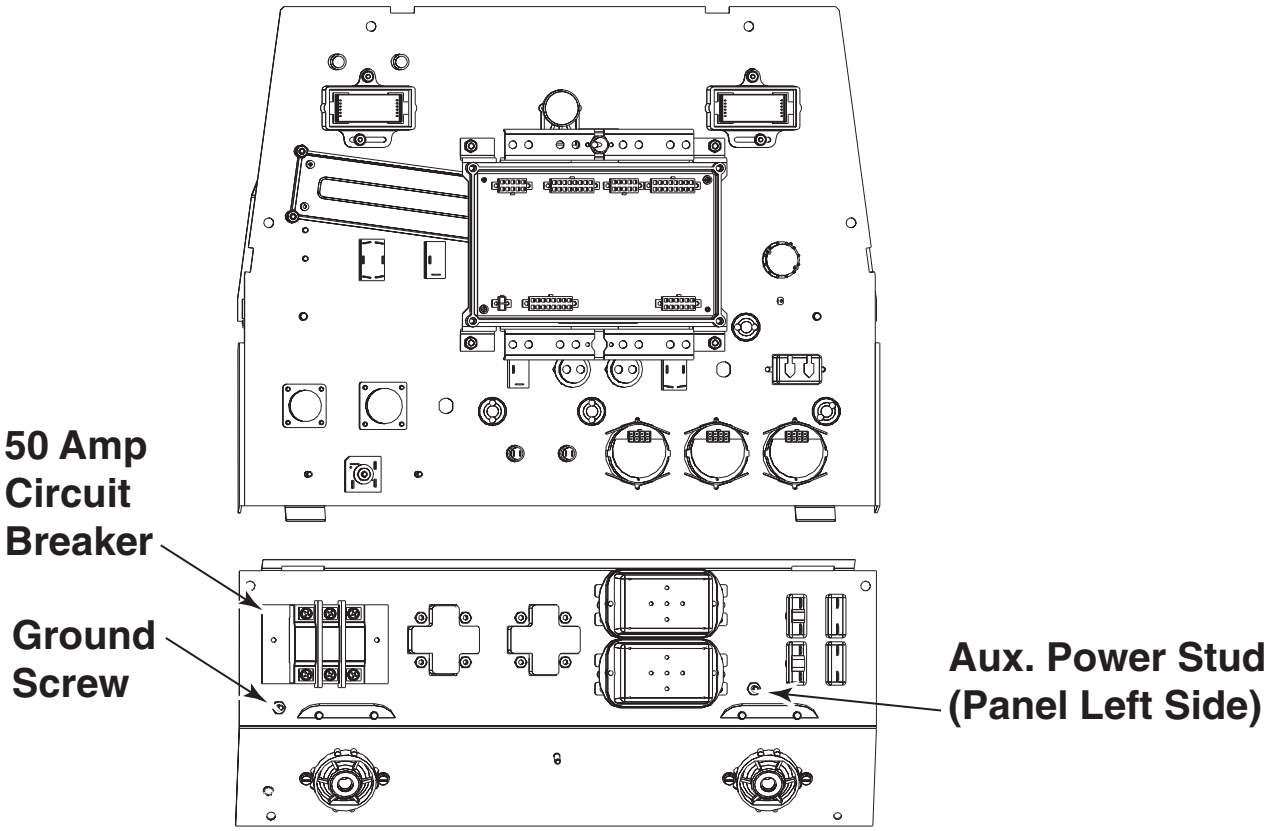
STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.22 – CONTROL & OUTPUT PANELS - REAR VIEW



1. Using a 7/16” wrench, disconnect stator lead #6 from the auxiliary power stud on the left side of the control box. See Figure F.22.

17. With a 3/8” wrench, disconnect lead #5 from the center ground stud (nearest the control transformer). See Figure F.22.

18. Using a phillips screw driver, remove lead #3 from the top 50A circuit breaker for the 120/240V receptacle. See Figure F.22.

NOTE: This lead must be wound two turns clockwise through the toroid (opposite in direction from leads #6A).

19. Disconnect lead #5A from the auxiliary power ground stud (left side of the control box, next to the 120V circuit breaker). See Figure F.22.

20. Using a 3/8” wrench, remove the two screws holding the control box to the top of the fan baffle.

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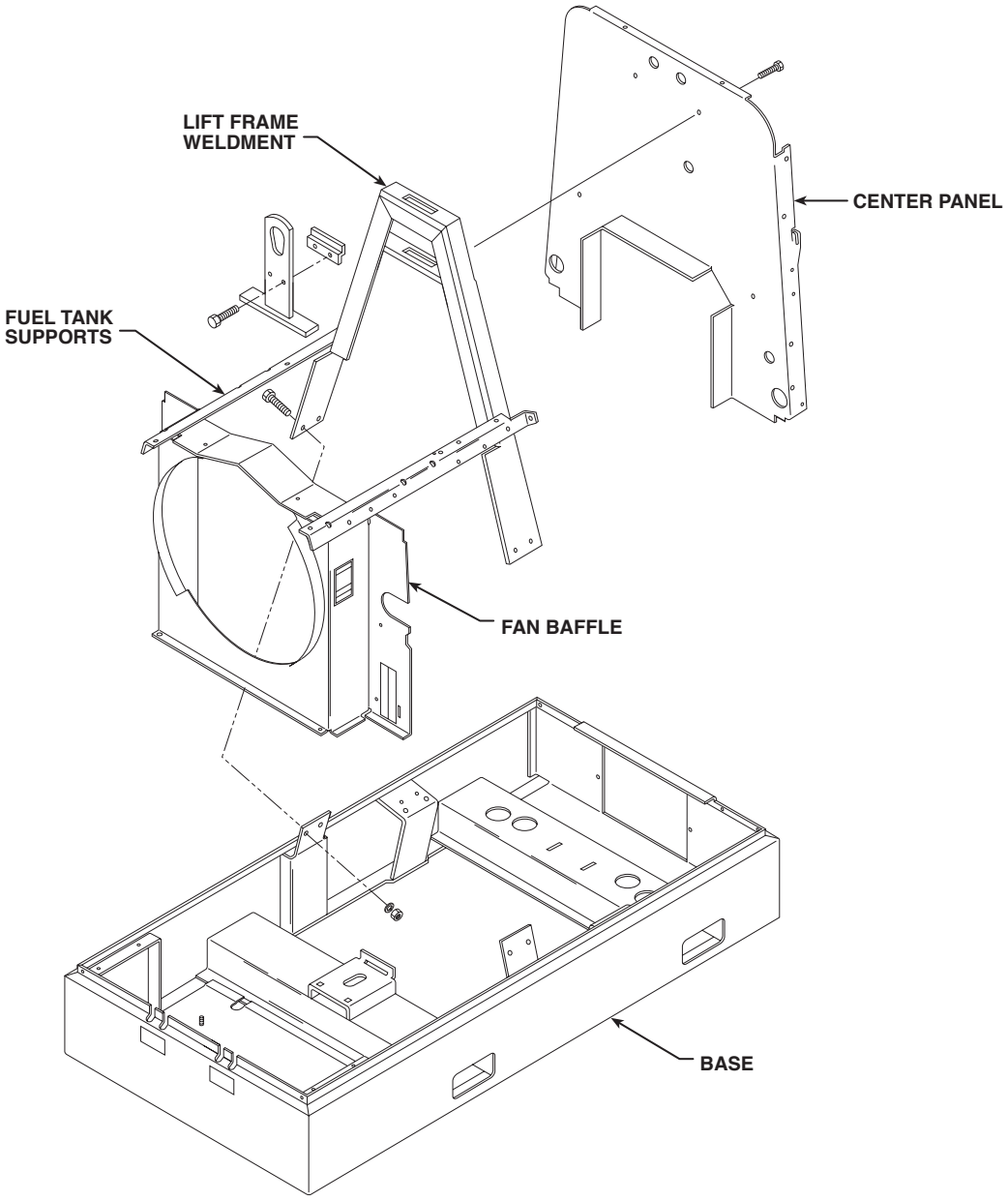
STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.23 – DOOR REMOVAL



In steps 21 - 25, the lift frame weldment, fuel tank supports, and fan baffle are removed as a unit. See Figure F.23.

21. Using a 3/8” wrench, remove the two bolts (at top) that hold the firewall to the lift frame weldment.

22. Using a 1/2” wrench, remove the two bolts (at bottom) that hold the firewall to the lift frame weldment.

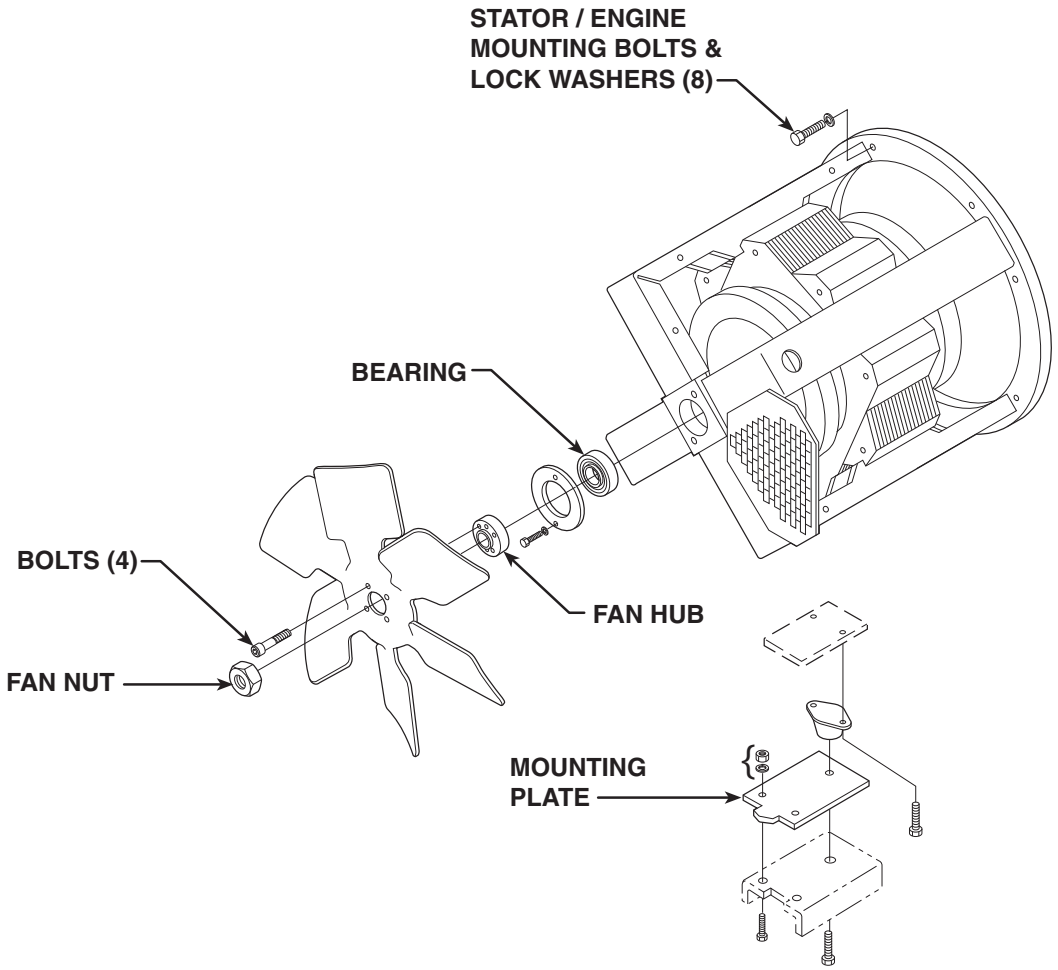
23. With a 3/8” wrench, remove the nuts, lock washers, and flat washers from the two studs that hold the fan baffle to the machine base.

24. Using a 3/4” wrench, remove the four bolts, lock washers, and nuts from the bottom of the lift frame weldment.

25. Carefully remove the lift frame weldment, fuel tank supports, and attached fan baffle. You will need to lift the fan baffle off the two studs on the machine base, then cock it slightly to remove it.

STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.24 – DOOR REMOVAL

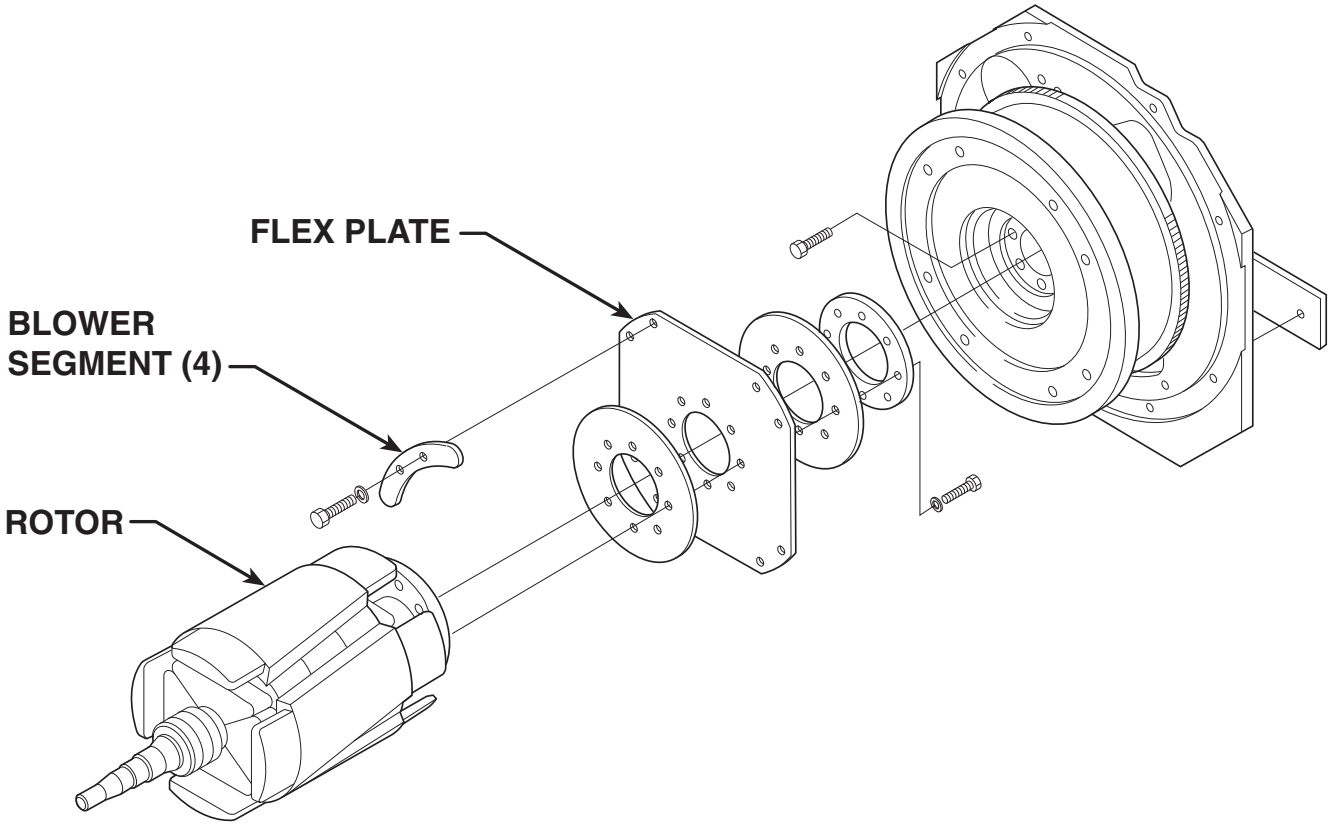


STATOR REMOVAL PROCEDURE

1. Using a 1/2” wrench, remove the four fan blade mounting bolts and lock washers. See Figure F.24.
2. Using a 1 1/8” wrench, remove the fan nut. Remove the fan, noting the direction for reassembly.
3. Using the gear puller, remove the fan hub.
4. Using a 3/8” wrench, remove the two bolts and flat washers holding the bearing in place.
5. Using a 1/2” wrench, remove the two nuts, lock washers, and carriage bolts holding the generator mounting plate to the machine base.
6. Support the stator with a hoist. Place wooden blocks under the engine to support it when the stator is removed.
7. Using a 9/16” wrench, remove the eight bolts and lock washers holding the stator to the engine.
8. Remove the stator from the engine. It may be necessary to pry and slide it free.

STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.25 – DOOR REMOVAL



ROTOR REMOVAL PROCEDURE

1. Support the rotor with a hoist.

2. Using a 5/16” wrench, remove the flex plate bolts, lock washers, and four blower segments. See Figure F.25.

⚠ WARNING

The rotor will be free to fall when the bolts are removed.

3. Using the hoist, carefully remove the rotor and flex plate assembly.

REASSEMBLY NOTES

Reassemble the rotor and stator to the Vantage® 400 by carefully retracting the disassembly procedure steps in reverse order. Keep the following special points in mind as you proceed.

1. INSTALL ROTOR: Support the rotor with the hoist. Install the blower segments and flex plate to the engine flywheel.

2. INSTALL STATOR: Be sure the engine is blocked securely and the stator is supported by the hoist. Install the stator to the engine with the eight bolts and lock washers. Install the fan blade, making sure that it faces the proper direction, with the fan nut and four cap screws.

3. Check the air gap for .012” minimum.

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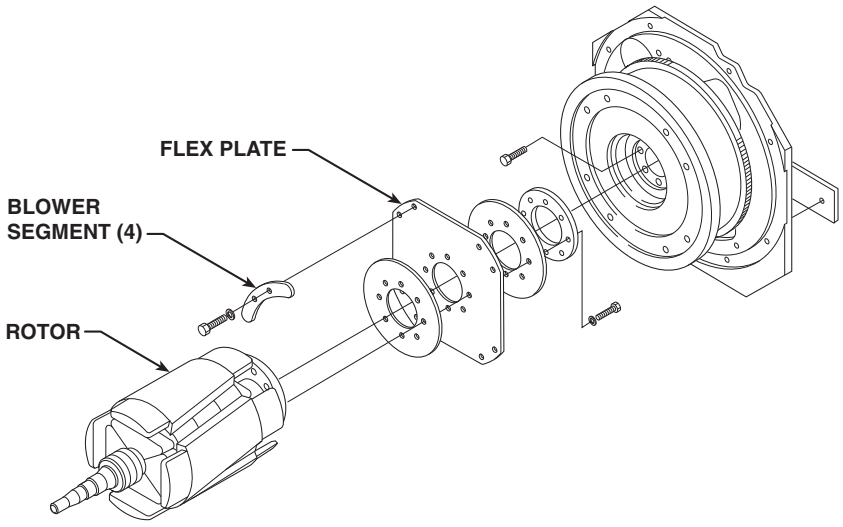
STATOR/ROTOR REMOVAL AND REPLACEMENT PROCEDURE
(CONTINUED)

FIGURE F.29 – ROTOR REMOVAL & REPLACEMENT



PROCEDURE

1. Remove the screws and disc clamping bars from the rotor coupling disc, and remove the rotor.

NOTE: earlier machines used three 0.31” thick clamping bars and later models use six 0.14” thick clamping bars arranged in three sets of two bars each.

If the rotor is to be replaced, remove the screws, rotor clamping ring and coupling disc from the rotor hub.

Replacing the Rotor

1. Whenever the rotor and stator are separated, it is highly recommended that a new bearing and tolerance ring be installed when the rotor and stator are reassembled.

2. Examine the rotor, coupling disc, clamping ring, clamping bars, screws, lock washers, and the engine flywheel. Make sure that all of the parts are clean and in good condition.

3. Install a new bearing on the rotor shaft.

4. Assemble the coupling disc and clamping ring to the rotor hub. The surface of the disc with the stamping burrs should be against the rotor hub. The side of the clamping ring with the radius should be placed against the coupling disc. See Figure F.29.

5. Insert the screws with lock washers and evenly tighten to a torque of 17 to 19 Ft-Lbs.

6. Lift the rotor assembly with the hoist and lifting straps and recheck the engine flywheel and coupling disk for anything that might prevent proper seating.

7. To attach the coupling disk to the engine flywheel, align the screw holes and insert the six screws, with lock washers, through the disc clamping bars and the coupling disc and into the engine flywheel.

8. Evenly tighten all the screws to a torque of 17 to 19 Ft-Lbs.

RETEST AFTER REPAIR

Retest a machine:

- If it is rejected under test for any reason that requires you to remove any mechanical part which could affect the machine's electrical characteristics. OR
- If you repair or replace any electrical components.

ENGINE OUTPUT

Mode	No Load RPM	Load RPM
Low Idle	1300 - 1400	N/A
High Idle	1860 - 1890	1800

WELDER DC (STICK) OUTPUT (ARC control @ -10)

Mode Selector Switch	Output Control	Open Circuit Volts	Load Volts	Load Amps
Stick (CC)	Maximum	55-60	36-38	400

WELDER CV (WIRE) OUTPUT (ARC Control @ +10)

Mode Selector Switch	Output Control	Open Circuit Voltage	Load Volts	Load Amps
CV	Maximum	55-60	36-38	290-310
CV	Minimum	55-60	17-19	220

TOUCH START TIG (ARC Control @ +10)

Mode Selector Switch	Output Control	Open Circuit Voltage	Load Volts	Load Amps
TIG	Maximum	10-15	18-22	240-260
TIG	Minimum	10-15	Short Circuit	18-28

AUXILIARY POWER OUTPUT

240 Volt Receptacle			120 Volt Receptacles		
Open Circuit Voltage	Load Volts	Load Amps	Open Circuit Voltage	Load Volts	Load Amps
230-264*	216-252	50	115-132	108-126	20

* Upper limit reflects cold machine, voltage will be below 132/264 for machine at normal operating temperature.

42 VOLT WIRE FEEDER POWER

Open Circuit Voltage	Load Volts	Load Amps
40-50	38-48	8=.5

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TABLE OF CONTENTS - DIAGRAM SECTION

*** NOTE:** Many PC Board Assemblies are now totally encapsulated, surface mounted and or multi-layered and are therefore considered to be unserviceable. Assembly drawings of these boards are no longer provided.

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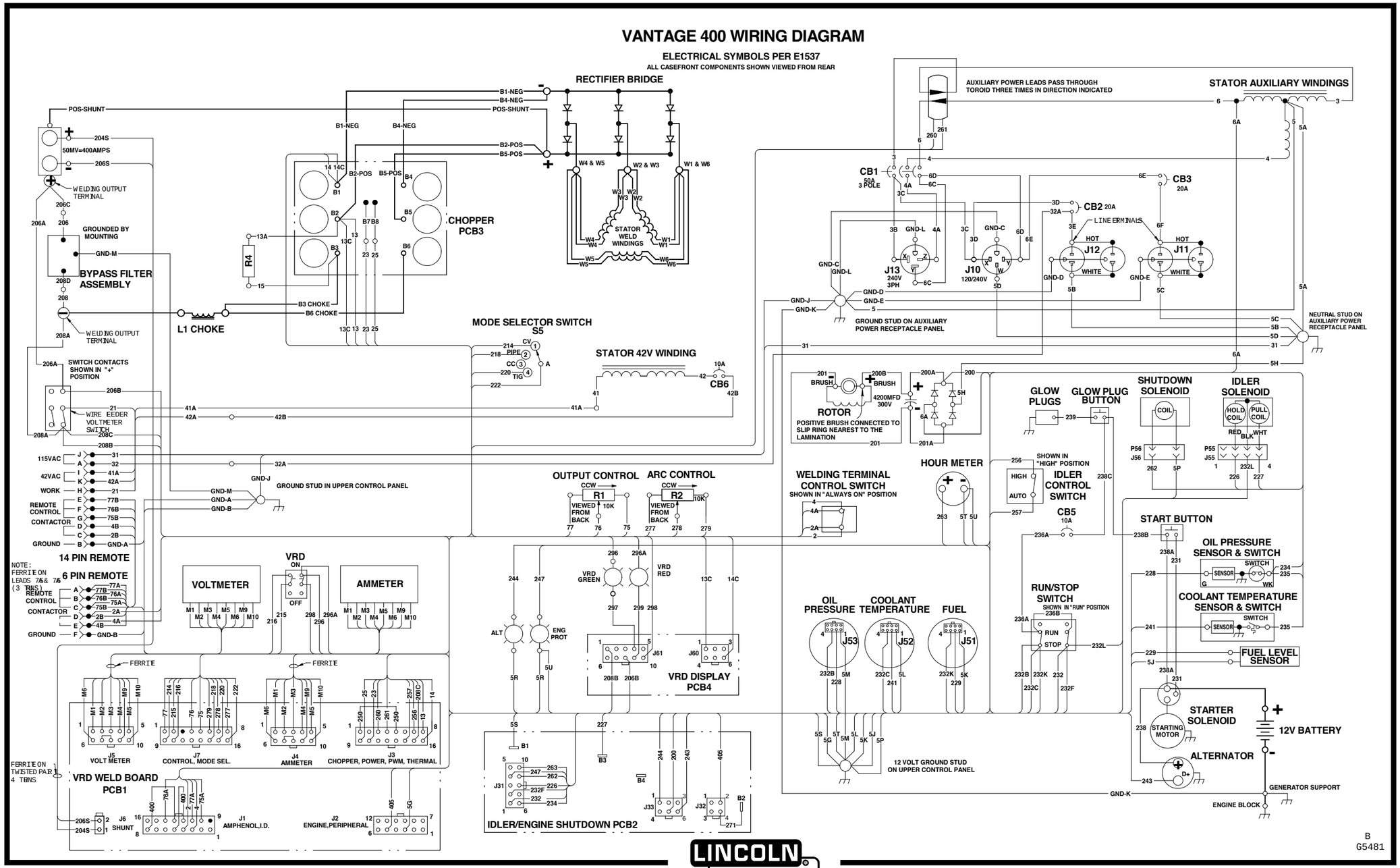
WIRING DIAGRAM - COMPLETE MACHINE - (G5481)



LINCOLN ELECTRIC

CLEVELAND, OHIO, U.S.A.

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual. The wiring diagram specific to your code is pasted inside one of the enclosure panels of your machine.

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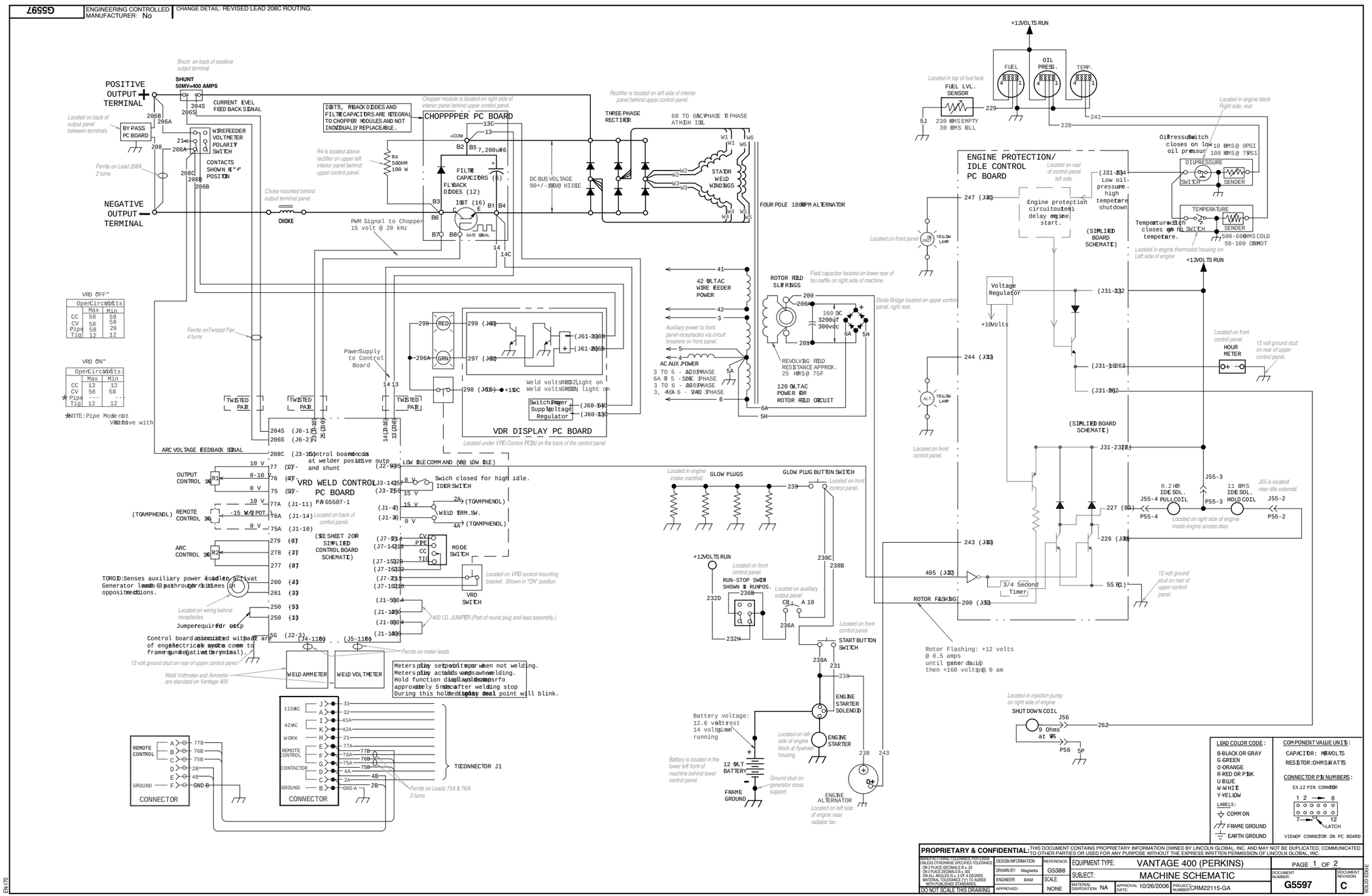
SCHEMATIC - COMPLETE MACHINE - (G5597 PAGE 1)

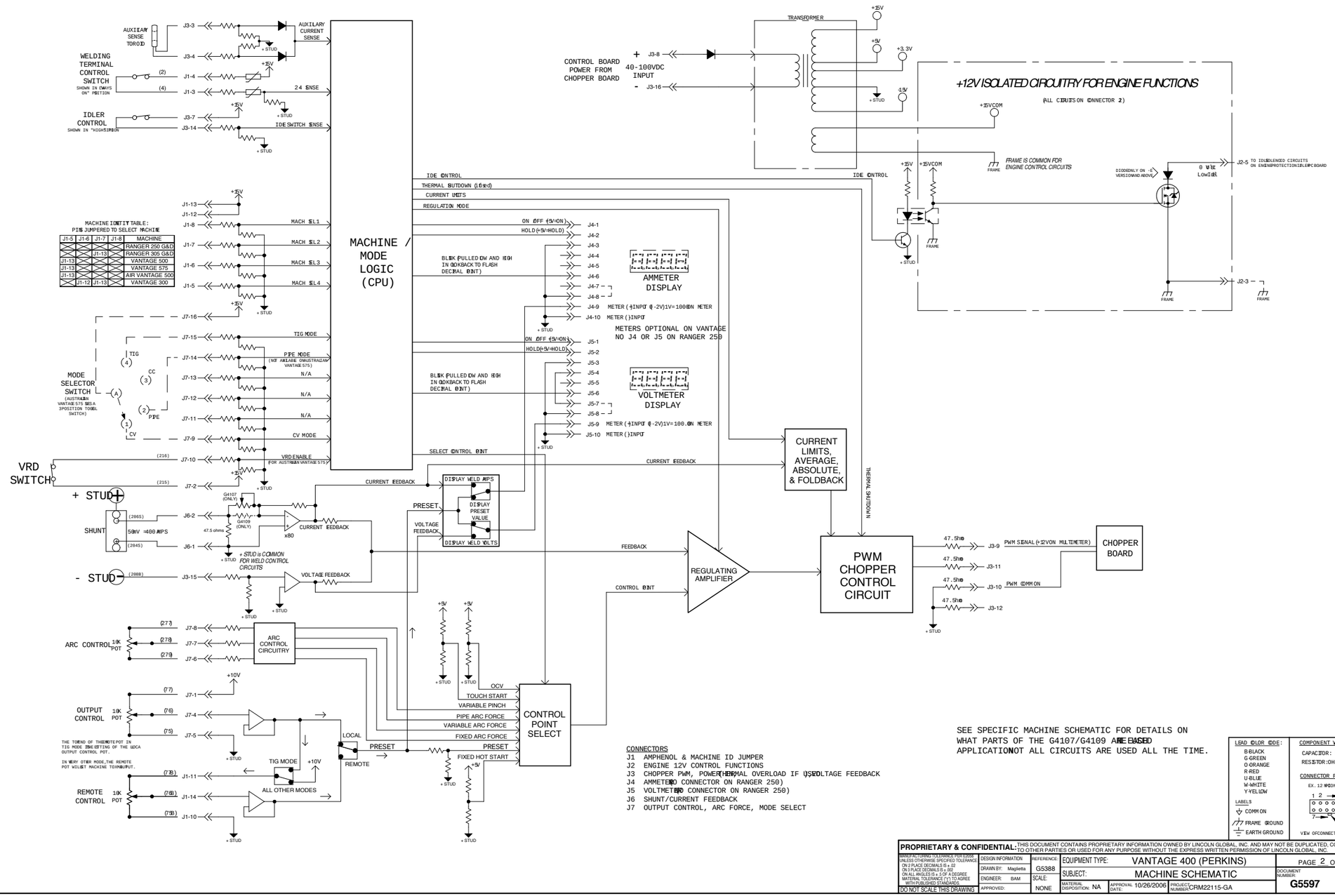


NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - COMPLETE MACHINE - (G5597 PAGE 2)

G5597 | ENGINEERING CONTROLLED MANUFACTURER: No | CHANGE DETAIL: REVISED LEAD 208C ROUTING.

SIMPLIFIED CONTROL BOARD SCHEMATIC



CONNECTORS

J1 AMPHENOL & MACHINE ID JUMPER
J2 ENGINE 12V CONTROL FUNCTIONS
J3 CHOPPER PWM, POWER, THERMAL OVERLOAD IF USED, VOLTAGE FEEDBACK
J4 AMMETER (NO CONNECTOR ON RANGER 250)
J5 VOLTMETER (NO CONNECTOR ON RANGER 250)
J6 SHUNT/CURRENT FEEDBACK
J7 OUTPUT CONTROL, ARC FORCE, MODE SELECT

SEE SPECIFIC MACHINE SCHEMATIC FOR DETAILS ON WHAT PARTS OF THE G4107/G4109 ARE USED IN THIS APPLICATION. NOT ALL CIRCUITS ARE USED ALL THE TIME.

LEAD COLOR CODE: B-BLACK, G-GREEN, O-ORANGE, R-RED, U-BLUE, W-WHITE, Y-YELLOW
LABELS: COMMON, FRAME GROUND, EARTH GROUND
COMPONENT VALUE UNITS: CAPACITOR: MFD/VOLTS; RESISTOR: OHMS/WATTS
CONNECTOR PIN NUMBERS: EX. 12 MS CONNECTOR; VIEW OF CONNECTOR ON PC BOARD

MANUFACTURING TOLERANCE PER E2035: UNLESS OTHERWISE SPECIFIED TOLERANCE ON 2 PLACE DECIMALS IS ± .02 ON 3 PLACE DECIMALS IS ± .010 ON ANGULAR DIMENSIONS IS ± 1 DEGREE. MATERIAL TOLERANCE (T) TO AGREE WITH PUBLISHED STANDARDS. DO NOT SCALE THIS DRAWING

DESIGN INFORMATION	REFERENCE:	EQUIPMENT TYPE: VANTAGE 400 (PERKINS)	PAGE 2 OF 2
DRAWN BY: Magletta	G5388	SUBJECT: MACHINE SCHEMATIC	DOCUMENT NUMBER: G5597
ENGINEER: BAM	SCALE: NONE	MATERIAL DISPOSITION: NA	APPROVAL DATE: 10/26/2006
APPROVED:		PROJECT NUMBER: CRM22115-GA	DOCUMENT REVISION: C

SOLID EDGE

EN-170

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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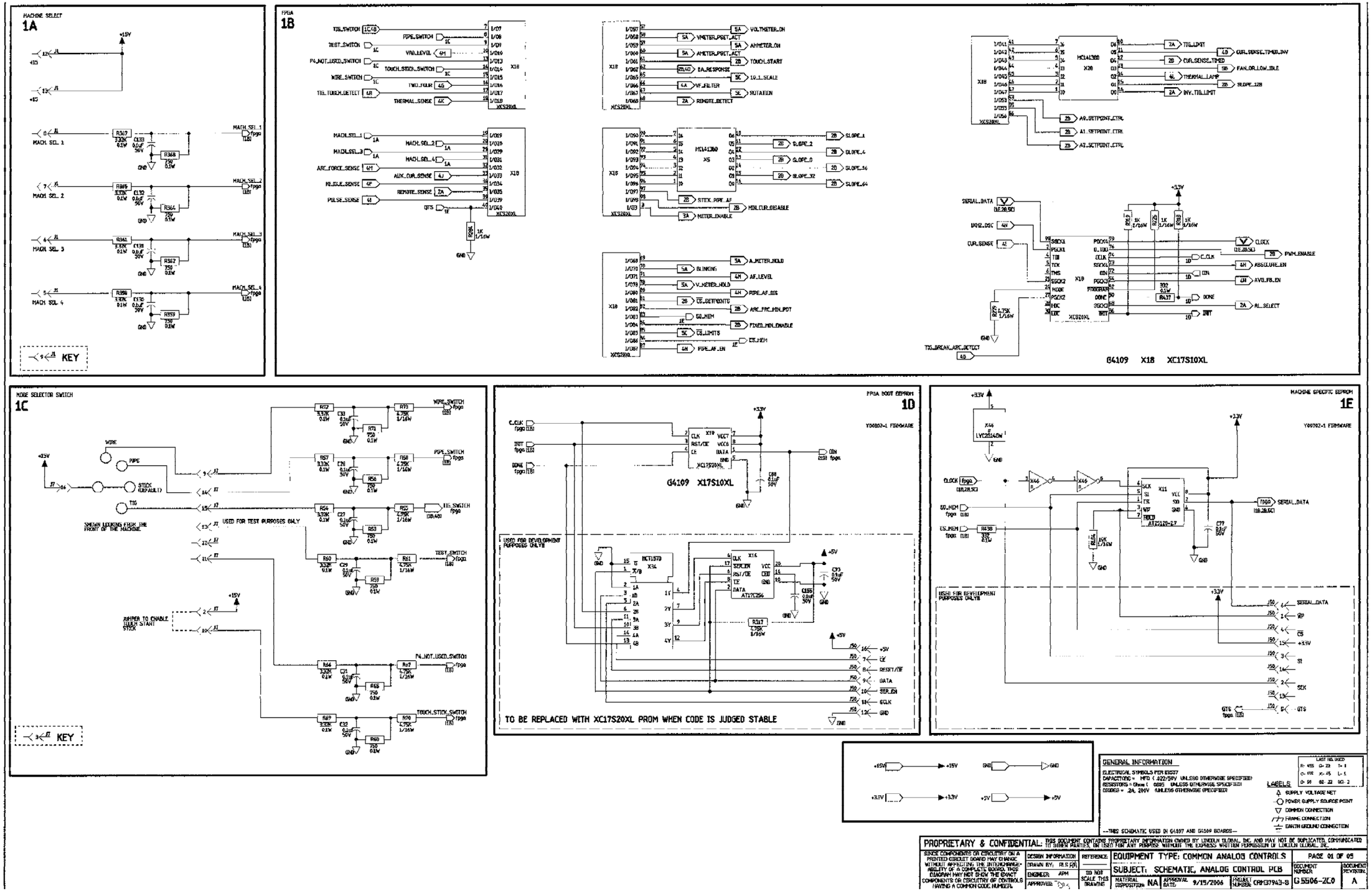
SCHEMATIC - WELD CONTROL PC BD. (G5506 PAGE 1 OF 5)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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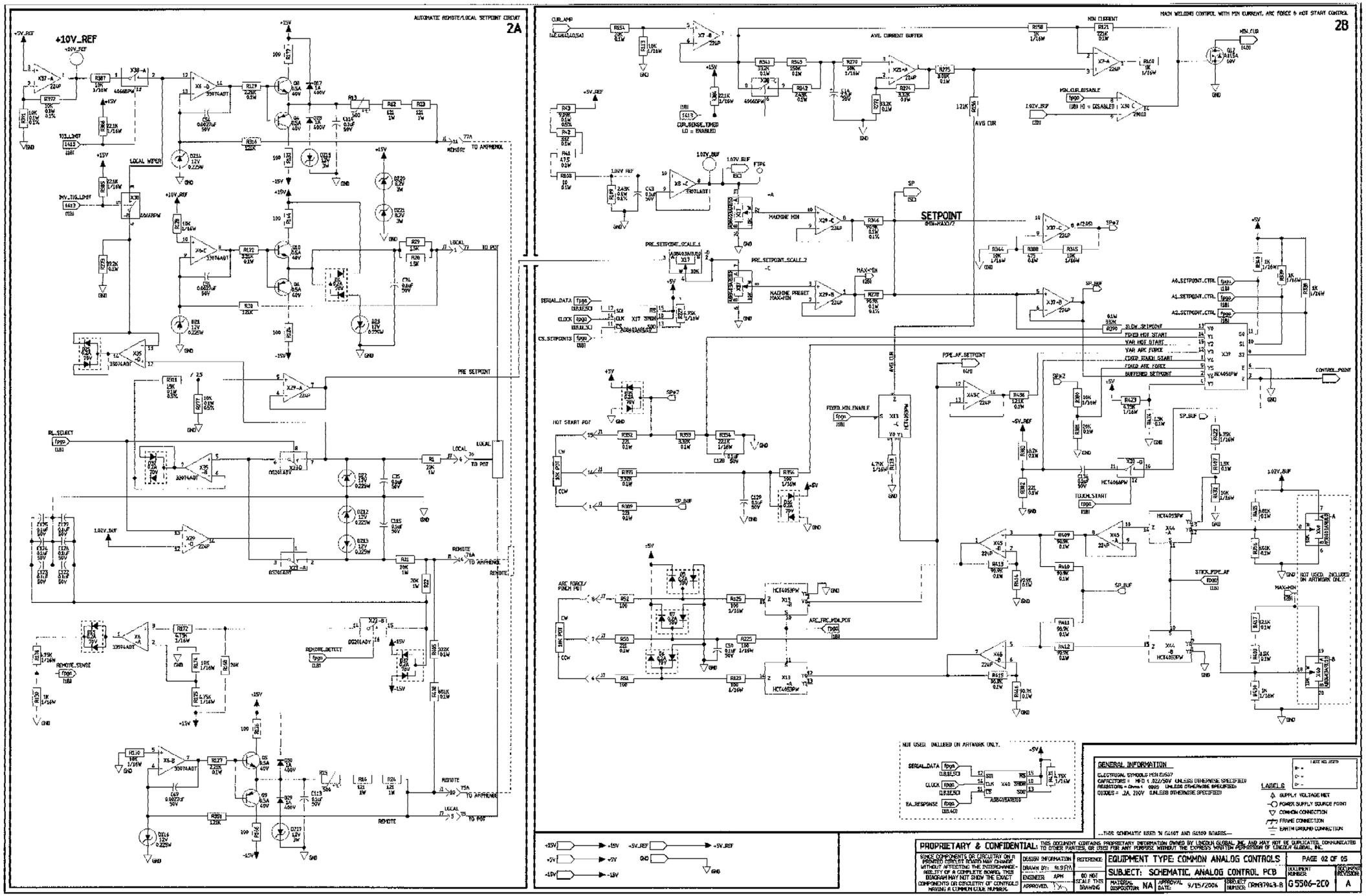
SCHEMATIC - WELD CONTROL PC BD. (G5506 PAGE 2 OF 5)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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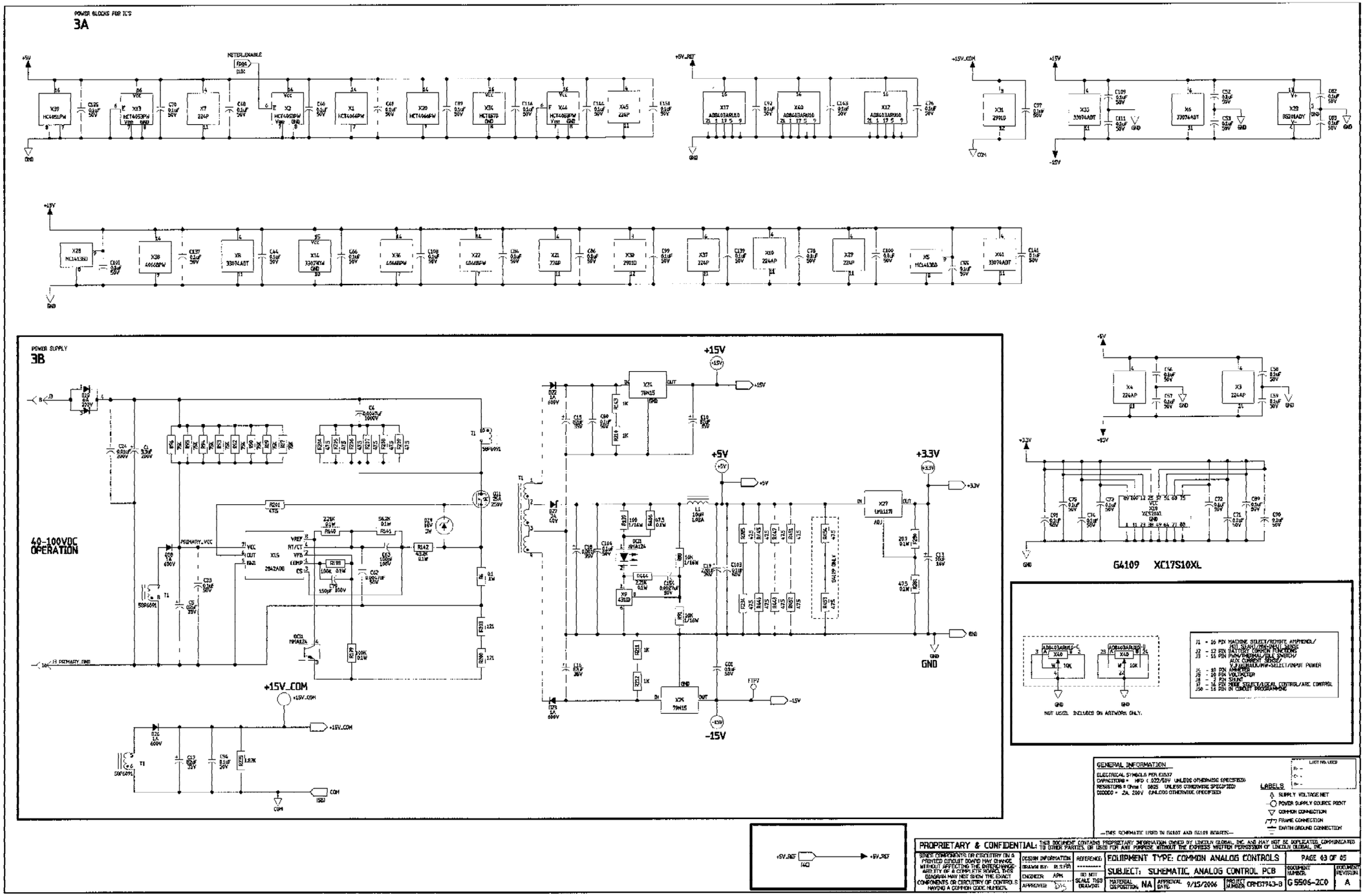
SCHEMATIC - WELD CONTROL PC BD. (G5506 PAGE 3 OF 5)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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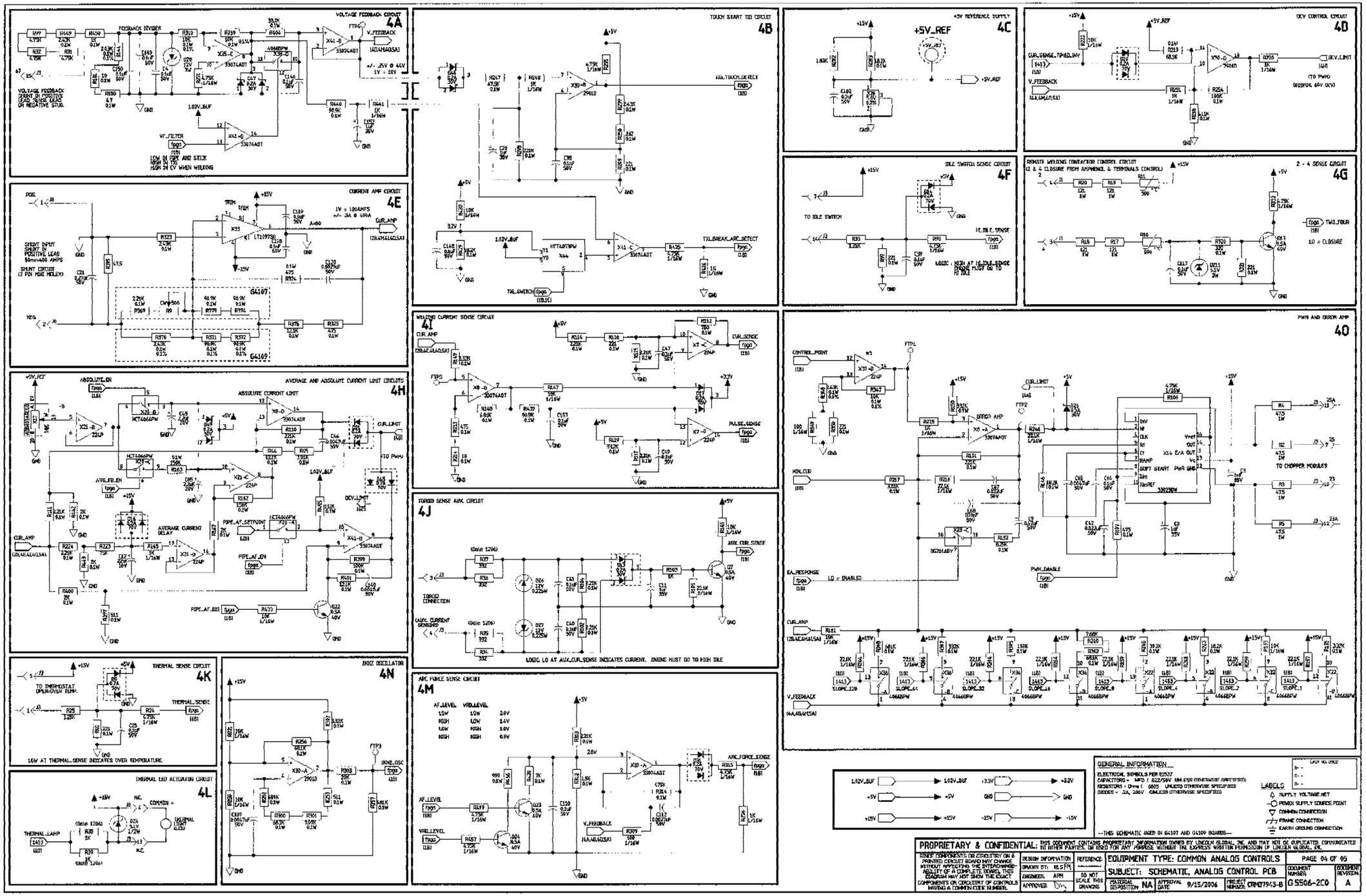
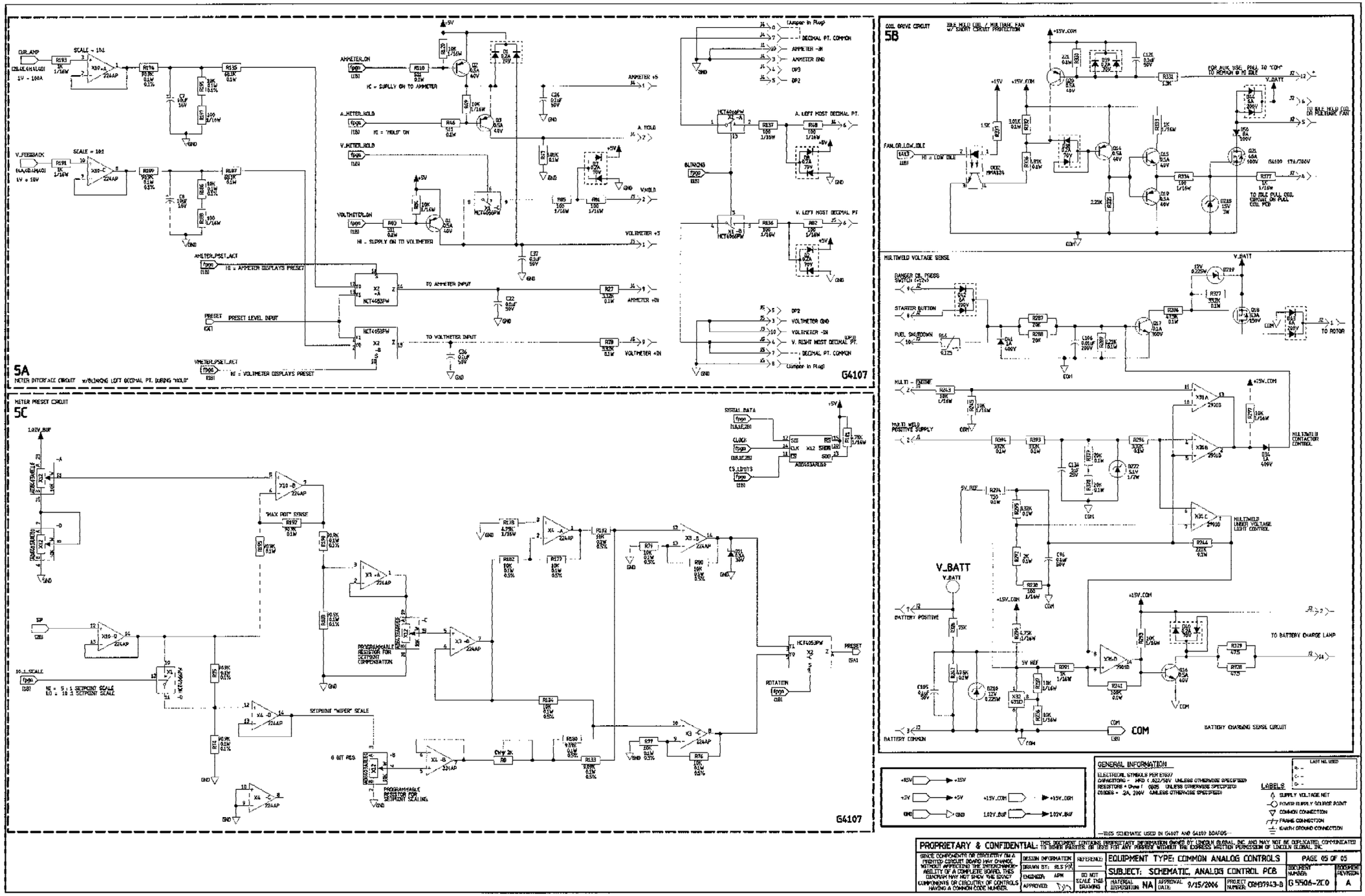
SCHEMATIC - WELD CONTROL PC BD. (G5506 PAGE 4 OF 5)



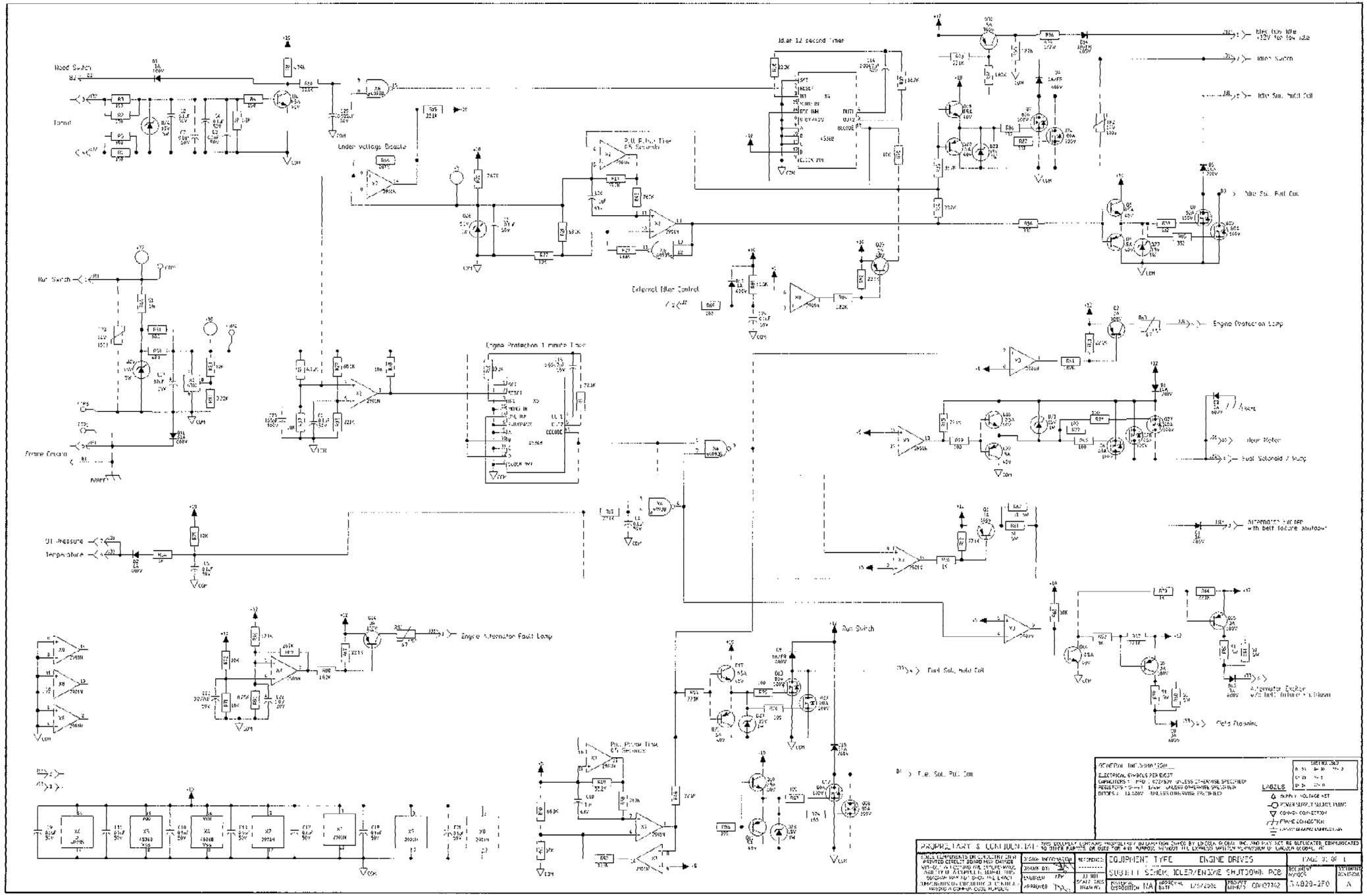
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - WELD CONTROL PC BD. (G5506 PAGE 5 OF 5)



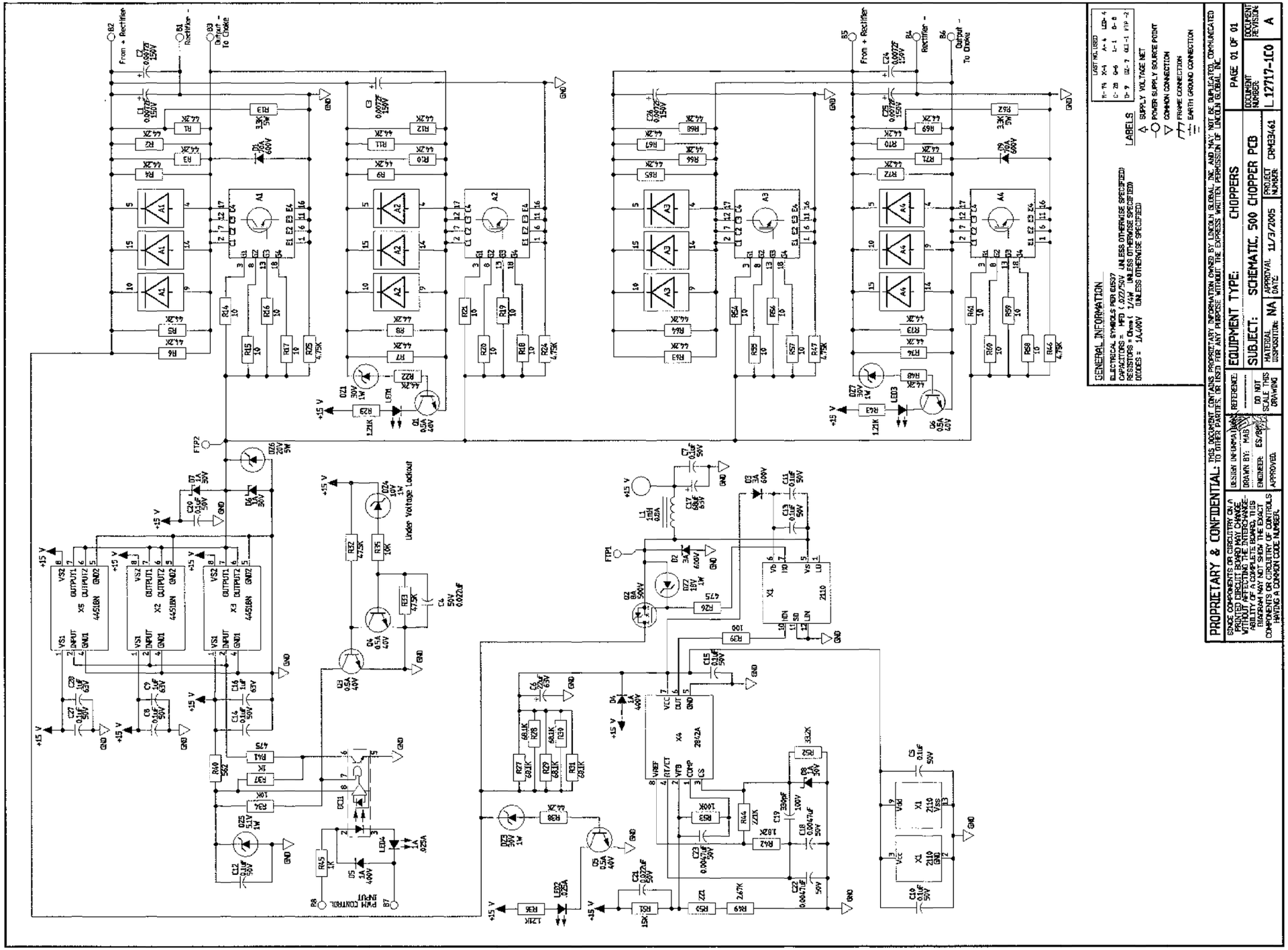
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - IDLER PC BD (G4828-2)



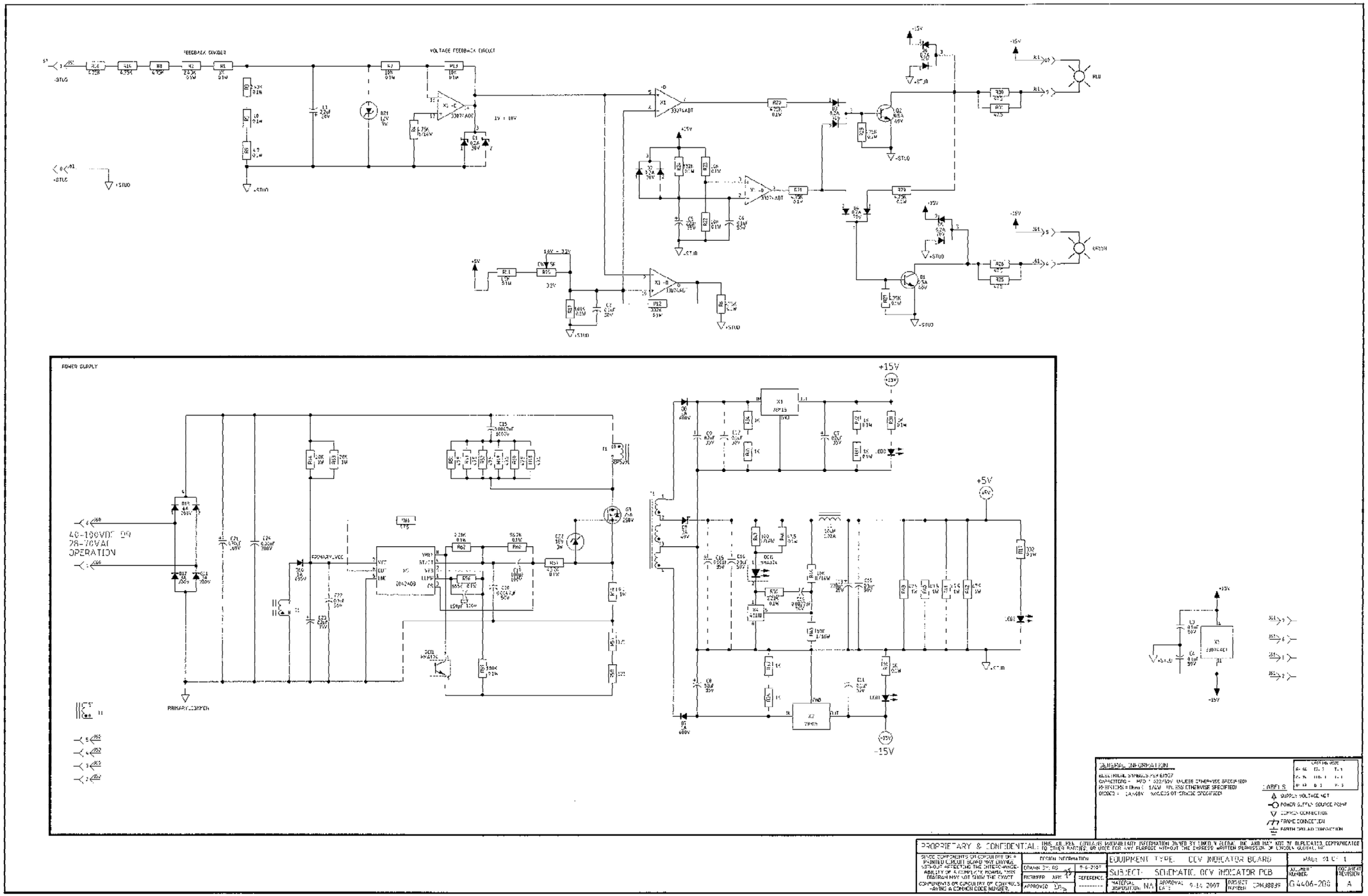
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - CHOPPER PC BD (L12717-1CO)



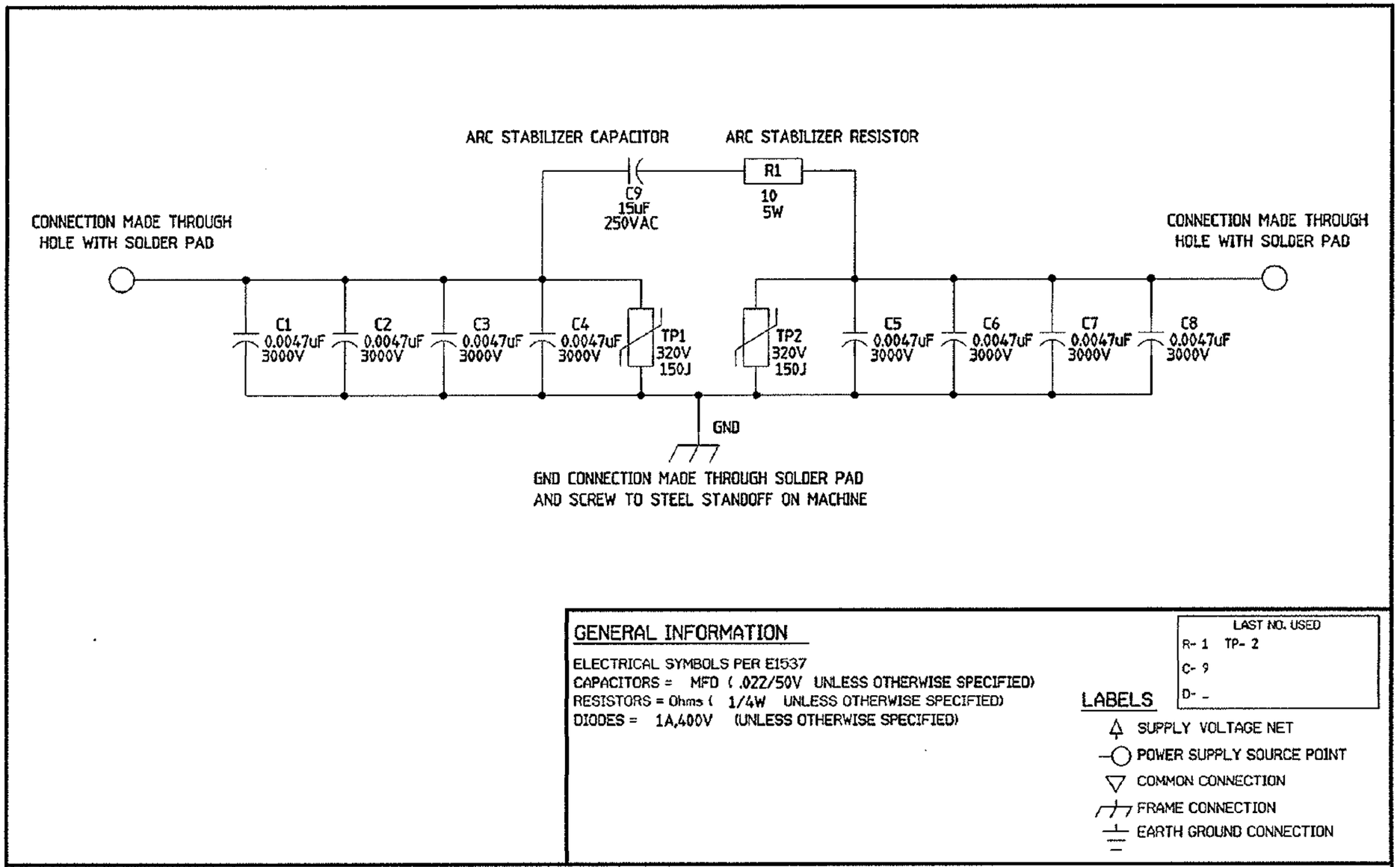
NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC -OCV INDICATOR PC BD (G4406-2D0)



NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

SCHEMATIC - BY PASS / STABILIZER PC BOARD (S22530-3D0)



GENERAL INFORMATION

ELECTRICAL SYMBOLS PER E1537
CAPACITORS = MFD (.022/50V UNLESS OTHERWISE SPECIFIED)
RESISTORS = Ohms (1/4W UNLESS OTHERWISE SPECIFIED)
DIODES = 1A,400V (UNLESS OTHERWISE SPECIFIED)

LAST NO. USED	
R- 1	TP- 2
C- 9	
D- -	

LABELS

- SUPPLY VOLTAGE NET
- POWER SUPPLY SOURCE POINT
- COMMON CONNECTION
- FRAME CONNECTION
- EARTH GROUND CONNECTION

SINCE COMPONENTS OR CIRCUITRY ON A PRINTED CIRCUIT BOARD MAY CHANGE WITHOUT AFFECTING THE INTERCHANGE-ABILITY OF A COMPLETE BOARD, THIS DIAGRAM MAY NOT SHOW THE EXACT COMPONENTS OR CIRCUITRY OF CONTROLS HAVING A COMMON CODE NUMBER.	DESIGN INFORMATION	REFERENCE: S22530	EQUIPMENT TYPE: SW TIG 175 & 275			PAGE 01 OF 1
	DRAWN BY: FM		SUBJECT: SCHEMATIC, BYPASS/STABILIZER PCB			DOCUMENT NUMBER: S 22530-3D0 / DOCUMENT REVISION: A
	ENGINEER: TN	DO NOT SCALE THIS DRAWING	MATERIAL DISPOSITION: NA	APPROVAL DATE: 8/22/2006	PROJECT NUMBER: CRM38150-A	
	APPROVED:					

NOTE: This diagram is for reference only. It may not be accurate for all machines covered by this manual.

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Return to Section TOC
Return to Master TOC

PC BOARD ASSEMBLY - BY PASS / STABILIZER PC BOARD (L10121-3)

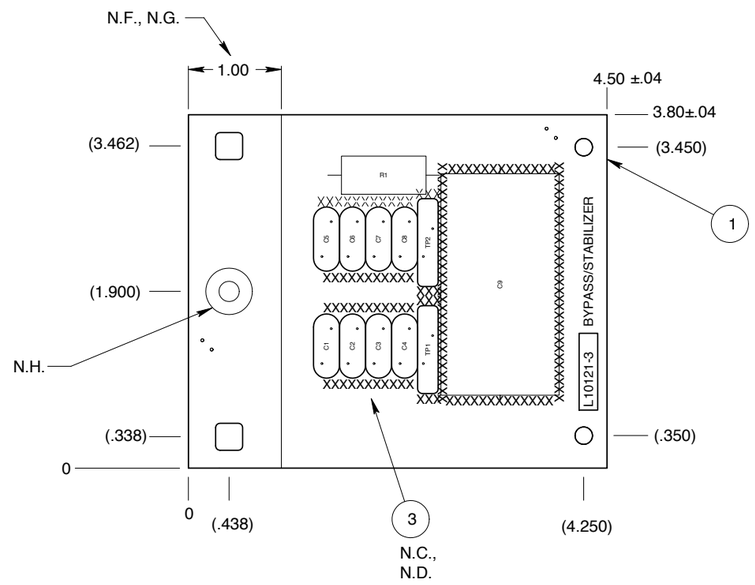
L10121-3 | ENGINEERING CONTROLLED | MANUFACTURER: No | CHANGE DETAIL: REVISED P.C. BOARD BLANK INFORMATION

REFERENCES	QTY	PART NUMBER	DESCRIPTION
C1, C2, C3, C4, C5, C6, C7, C8	8	T11577-58K	CAPACITOR,CD,.0047,3000V,20%
C9	1	S13490-155	CAPACITOR,POLYPROPYLENE METALLIZED FILM,PPMF,15MF,250VAC,10%
R1	1	T14648-25	RESISTOR,WW,5W,10,5%,SQ
TP1, TP2	2	T13640-18	MOV,320VRMS,150J,20MM

CAPACITORS = MFD/VOLTS
INDUCTANCE = HENRYS

P.C. BOARD BLANK INFORMATION
BUY COMPLETE AS L10121-D (2 LAYER BOARD PER E3281 WITH LEAD FREE HASL SURFACE FINISH).
MAKES 12 BOARDS PER PANEL.
SEE ELECTRONIC FILE FOR ADDITIONAL INFORMATION

ITEM	REQ'D	PART NO.	IDENTIFICATION
1	1	SEE BLANK INFO.	P.C. BOARD BLANK
3	.16 OZ	E2861	SEALANT



NOTES:

N.C. SQUEEZE TOGETHER ITEMS C1-C4, TP1 AND C5-C9, TP2 BEFORE APPLYING SEALANT.

N.D. APPLY SEALANT AS SHOWN.

N.F. KEEP THIS AREA FREE OF ENCAPSULATION, TOP AND BOTTOM OF BOARD.

N.G. TIN ALL EXPOSED COPPER WITH SOLDER IN THIS AREA, BOTH SIDES OF BOARD.

N.H. NO ICICLES OR SOLDER BLOBS ARE PERMITTED WITHIN 0.5" Ø (BOTH SIDES).

MANUFACTURED AS:

L10121-3D0

IDENTIFICATION CODE

MAKE PER E1911-ROHS

ENCAPSULATE WITH E1844, 2 COATS.

TEST PER E3553-B

SCHEMATIC REFERENCE: S22530-3D0

ALL COMPONENTS AND MATERIALS USED IN THIS ASSEMBLY ARE TO BE RoHS COMPLIANT PER E4253.

FOR PARTS ORDERS ONLY:

INCLUDE S22772PRINT

EJN-168

MANUFACTURING TOLERANCE PER E2056
UNLESS OTHERWISE SPECIFIED TOLERANCE:
ON 2 PLACE DECIMALS IS ± .02 in. (± 0.5 mm)
ON 3 PLACE DECIMALS IS ± .002 in. (± 0.05 mm)
ON ALL ANGLES IS ± 5 OF A DEGREE
MATERIAL TOLERANCE ("L") TO AGREE WITH PUBLISHED STANDARDS.
DO NOT SCALE THIS DRAWING

CONTROL: CLEVELAND
DRAWN BY: fivory
ENGINEER: -
APPROVED: -

SCALE: 1:1 IF PRINTED @ A2 SIZE
UNITS: INCH

EQUIPMENT TYPE: SW TIG 175 & 275
SUBJECT: BYPASS/STABILIZER P.C. BOARD ASSEMBLY
MATERIAL DISPOSITION: UF
APPROVAL DATE: 9-2007
PROJECT NUMBER: CRM34432
REFERENCE: L10121-1

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DOCUMENT NUMBER: L10121-3
DOCUMENT REVISION: C
SOLID EDGE

Insight

NOTE: Lincoln Electric assumes no responsibility for liablilities resulting from board level troubleshooting. PC Board repairs will invalidate your factory warranty. **Individual Printed Circuit Board Components are not available from Lincoln Electric.** This information is provided for reference only. Lincoln Electric discourages board level troubleshooting and repair since it may compromise the quality of the design and may result in danger to the Machine Operator or Technician. Improper PC board repairs could result in damage to the machine.

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